Project Status Report

High End Computing Capability
Strategic Capabilities Assets Program

December 10, 2015

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Facilities Experts Begin Implementation Phase of Modular Supercomputing Facility

- The HECC Facilities team, working with NASA Ames facilities engineers (Code J), completed the design for, and began the implementation phase of, the prototype Modular Supercomputing Facility (MSF) at the NASA Advanced Supercomputing (NAS) facility.
- The first Data Center Unit (DCU)-20 module is being constructed, and will be shipped to NASA Ames Research Center (ARC) in January 2016.The initial implementation will consist of 1 DCU-20 module, 4 compute racks, and 1 service rack.
- The HECC team hosted a working meeting with supplier SGI/CommScope and various Ames experts (including structural engineers, the ARC deputy fire marshal, electrical engineers, head of ARC physical security) to work through challenges and exchange information.
- The team also hosted a site visit for Multiple Award Construction Contracts (MACC) businesses that submitted bids on November 16; bids are currently being reviewed.
- Orders for key electrical infrastructure, including switch gear and a 2.5-megawatt transformer, were placed.
- The site is sized to accommodate 2 DCU-20 modules (up to 32 compute racks) and has a 2.5-megawatt power capacity to accommodate any future upgrades.

Mission Impact: The MSF prototype will demonstrate the feasibility of energy-efficient modular computing, which could ultimately more than double NASA HECCs supercomputing capability.

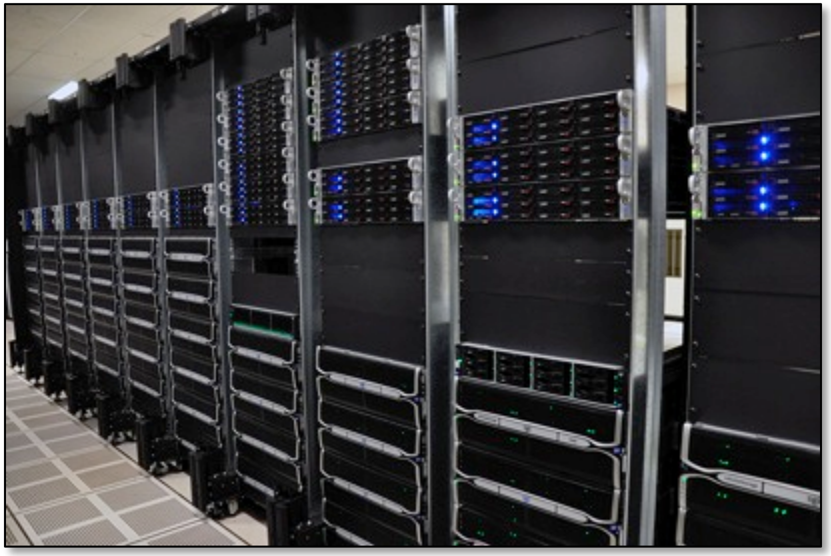
Artist's rendering of the Modular Supercomputing Facility (MSF) is shown in its actual location at NASA Ames. The site is sized for two modules to be placed side by side. Utilities for the MSF will be brought to the site in underground conduits. *Marco Librero, NASA/ Ames*

POCs: William Thigpen, william.w.thigpen@nasa.gov, (650) 604-1061, NASA Advanced Supercomputing (NAS) Division;
Chris Buchanan, chris.buchanan@nasa.gov, (650) 604-4308, NAS Division, CSGov, Inc.

HECC Deploys Lustre Storage Augmentation

- HECC deployed a new Lustre filesystem (procured in August 2015) to augment the short-term storage capacity of Pleiades.
- The total storage capacity procured was 18.7 petabytes (PB), unformatted. Approximately 14 PB will be available for general usage, with a formatted capacity of 11 PB. The remaining storage, approximately 4 PB unformatted, will be dedicated for visualization usage.
- The new Lustre storage capability delivers 83 gigabytes per second (GB/s) and 57 GB/s of random write and read performance, compared to the previous filesystem performance of 58 GB/s and 33.7 GB/s, respectively.
- HECC will coordinate the migration of user data to the new filesystem over the next several months. The data transfer will be completed as transparently as possible to minimize the impact on users' workflow.

Mission Impact: Increased storage capacity and performance will enable HECC researchers to more fully utilize the computing capability of the Pleiades and Endeavour supercomputers and run more data-intensive applications.



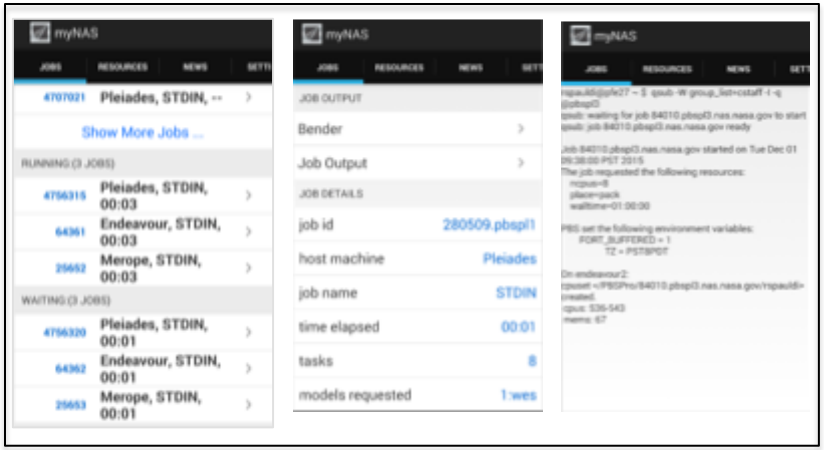
HECC's existing Lustre storage system consists of Data Direct Network and NetApp storage that totals approximately 20 petabytes (PB) of storage. The new NetApp storage provide nearly the same capacity, at 18.7 PB.

POCs: Bob Ciotti, bob.ciotti@nasa.gov, (650) 604-4408, NASA Advanced Supercomputing (NAS) Division;
Davin Chan, davin.chan@nasa.gov, (650) 604-3613, NAS Division, CSGov, Inc.

Android Version of myNAS Mobile App Released to HECC Users

- HECC's mobile application team released the first Android version of "myNAS," an app that facilitates remote monitoring of PBS jobs running on Pleiades and other HECC resources. This Android release joins the recent 1.1 version of the iOS app to provide support for Merope and Endeavour users.
- myNAS now runs on 98% of smartphones and 90% of tablets on the market, enabling most HECC users to:
  - View the status of submitted jobs, availability of HECC computing resources, and the latest HECC news.
  - Receive notifications when jobs change state or produce output, even when the app is not running.
  - View text or image output files on their devices (after including a simple command in the job submission script).
- A working prototype of the Android application was developed by a high school summer intern. At the end of the internship, the myNAS team took over the development, testing, and release process.
- For the next myNAS release (Android and iOS versions), the team plans to enhance the app with allocation management features for project principal investigators. Beyond that, they are working on extending myNAS functionality to web browsers.

Mission Impact: By providing access to the supercomputing environment on the two major mobile platforms, HECC is improving the productivity of end users who want to monitor jobs or resources.



The latest release of the myNAS mobile application brings remote access capability to HECC users on the Android platform for the first time. (Left to right: jobs screen, job detail screen, job output file screen.) Both the Android and iOS versions of the App now include support for monitoring PBS jobs on the Endeavour and Merope systems.

POCs: Ryan Spaulding, ryan.c.spaulding@nasa.gov; John Hardman, john.hardman@nasa.gov, (650) 604-0417; Robert Hood, robert.hood@nasa.gov, (650) 604-0740; NASA Advanced Supercomputing Division, CSGov, Inc.

Scheduled Maintenance Completed on HECC Systems

- HECC engineers completed maintenance activities on the Pleiades supercomputer to improve the stability and performance of the system, during a scheduled downtime on November 5.
- The InfiniBand (IB) firmware and software drivers were updated to address a bug that caused a system-wide outage on Pleiades in mid-October.
- Lustre performance tuning and stability changes were made to better handle the size of the IB fabric. One of the significant changes resolved an intermittent Lustre filesystem instability issue.
- Other activities included: installing system patches, replacing faulty components, running filesystem integrity checks on the Lustre filesystems, updating RAID firmware and deploying PBSPro 13.

Mission Impact: Regular maintenance on HECC resources provides a stable and well-performing environment for HECC users.

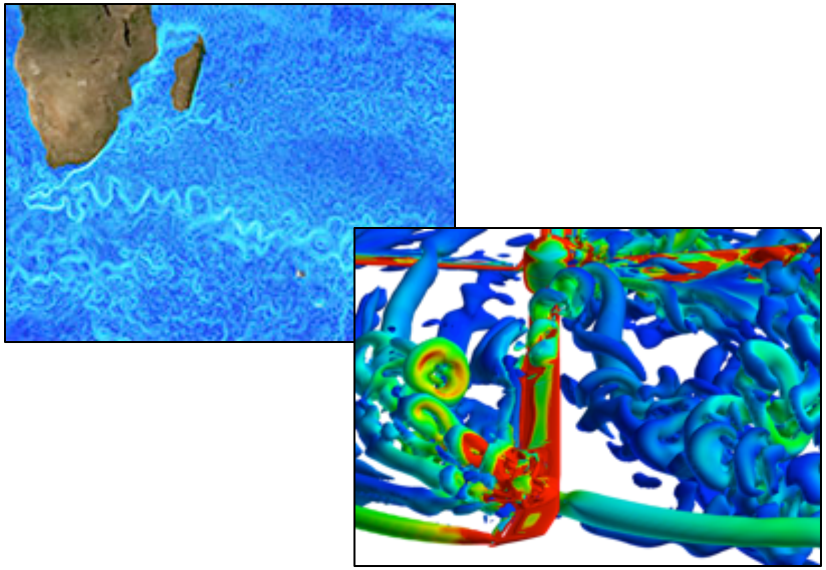
HECC engineers performed maintenance activities on the Pleiades supercomputer that could not be completed during normal operations.

POCs: Bob Ciotti, bob.ciotti@nasa.gov, (650) 604-4408, NASA Advanced Supercomputing (NAS) Division;
Davin Chan, davin.chan@nasa.gov, (650) 604-3613, NAS Division, CSGov, Inc.

New Allocation Period for Supercomputer Time Begins for Two Mission Directorates

- The new allocation period for the Aeronautics Research Mission Directorate (ARMD) and part of the Science Mission Directorate (SMD) began November 1.
- These organizations awarded allocations of computing time on Pleiades and Endeavour to over 250 computing projects.
- The combined awards, distributed approximately equally between ARMD and SMD, totaled 98 million Standard Billing Units (SBUs).
- With each organization receiving half of the Agency Reserve in addition to its own share, ARMD's requests totaled over 200% of its available time, and SMD's requests totaled over 300% of its available time.
- The new allocation period is an opportunity for each organization to assess demands for computing time and to rebalance allocations to meet computing needs for the next year.

Mission Impact: NASA programs and projects periodically review the distribution of supercomputer time to assess the demand for resources and assure consistency with mission-specific goals and objectives.



Representative images of ARMD and SMD projects supported by HECC resources .Top image: Snapshot of surface current speed in the Antarctic Circumpolar Current region, south of the Indian Ocean, in a global ocean simulation with 1-kilometer horizontal grid spacing. Chris Hill, Massachusetts Institute of Technology. Bottom image: Close-up view of a rotor blade undergoing dynamic stall. Neal M. Chaderjian, NASA/Ames.

POC: Catherine Schulbach, catherine.h.schulbach@nasa.gov, (650) 604-3180, NASA Advanced Supercomputing Division

* 1 SBU equals 1 hour of a Pleiades Westmere 12-core node

HECC Staff Lead Agency’s 28th Exhibit at Annual Supercomputing Conference

- A team from the HECC Project coordinated NASA’s presence at SC15, the 28th annual Supercomputing Conference, held November 16–19 in Austin, Texas.
- Users from 5 NASA locations and several universities presented results of 39 science and engineering projects enabled by Pleiades and Discover and supported by HECC & NCCS visualization, optimization, and networking experts.
- Featured demos included simulations of a revolutionary, fuel-saving aircraft design; SLS booster-separation scenarios; the formation of massive stars & star clusters; and an innovative combination of NASA and commercial cloud technologies.
- Stunning images and movies of science and engineering simulations, many created by HECC/NCCS visualization experts, were shown on the HECC 10- x 6-foot hyperwall.
- LaRC staff participated in the SC15 Job Fair, collecting over 1,000 resumes from students and recent graduates interested in NASA internships and job opportunities.
- The SC15 Test of Time Award was presented to a team of computer scientists from the original NAS program for their groundbreaking 1991 paper “The NAS Parallel Benchmarks - Summary and Preliminary Results.”
- Pleiades ranks 7th worldwide (4th in the U.S.) on the latest High Performance Conjugate Gradient (HPCG) Benchmark list; on the November TOP500 list, Pleiades ranks 13th worldwide (7th in the U.S) and Discover ranks 82nd worldwide (30th in the U.S.), as announced at SC15.

Visit the NASA@SC15 website at: www.nas.nasa.gov/SC15

Mission Impact: Participation in SC15 provided an important opportunity to exchange information with peers and HEC industry leaders from around the world, convey the importance of NASA missions, and meet with candidates for internship/job opportunities.

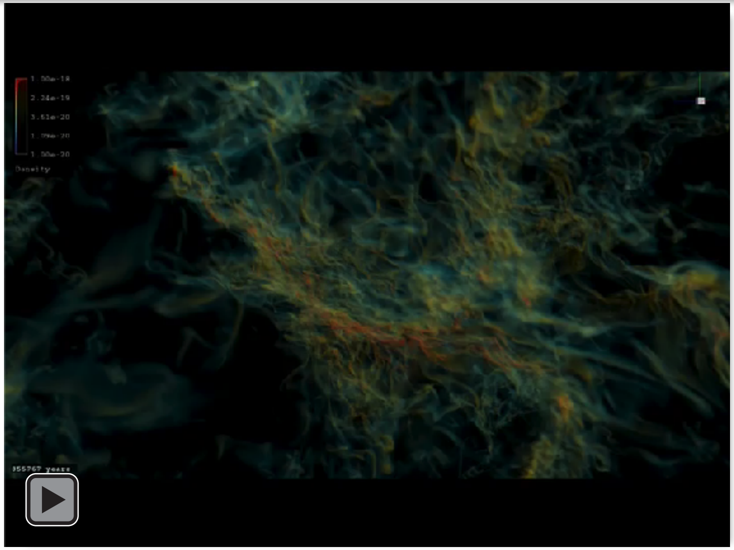
The 30-ft. x 40-ft. NASA booth at the SC15 conference in Austin, Texas was designed and supported by HECC staff to highlight the critical role of supercomputing in science and engineering projects across the agency. Inset: HECC user Richard Klein points out details in his simulations of star formation (see slide 9.)

POC: Gina Morello, gina.f.morello@nasa.gov, (650) 604-4462, NASA Advanced Supercomputing Division

Simulating Star Formation: From Giant Molecular Clouds to Protostellar Clusters *

- Researchers are running large-scale radiation-magnetohydrodynamics simulations on Pleiades to explore the origin of massive stars and star clusters—one of the most fundamental unsolved problems in astrophysics.
- Spanning over 700,000 years, the simulations follow the gravitational collapse of giant, magnetized, molecular clouds into turbulent clumps that condense into star-forming cores, ultimately evolving into star clusters.
- The researchers use ORION2, an advanced, 3D adaptive mesh refinement code developed at the University of California, Berkeley specifically for modeling and simulation of astrophysical phenomena. The simulations:
  - Use realistic initial conditions derived from various observatories, including the Hubble Space Telescope.
  - Incorporate a broad range of physical processes including: gravity, supersonic turbulence, hydrodynamics, radiation, magnetic fields, chemistry, and highly energetic outflows.
- The resulting 3D dataset provides the entire evolution of the formation of these protostars.
- At the end of a 700,000-year span, the number, stellar distribution, and properties of the magnetized clumps and the protostellar systems match well with data from several space-based observatories.

Mission Impact: Supporting NASA's goals to explore the origins of stars and planets, HECC resources enable astrophysicists to run simulations spanning immense scales of time and space and incorporating a broad range of physical processes.



An infrared dark cloud in a simulation generated by the ORION2 code shows a complex, turbulent, braided filamentary structure after nearly 700,000 years in its evolution, when protostars have begun to form deep within the structure. The protostars and clusters are seen by the bright luminosity they emit along the main and surrounding filaments.
David Ellsworth, Tim Sandstrom, NASA/Ames

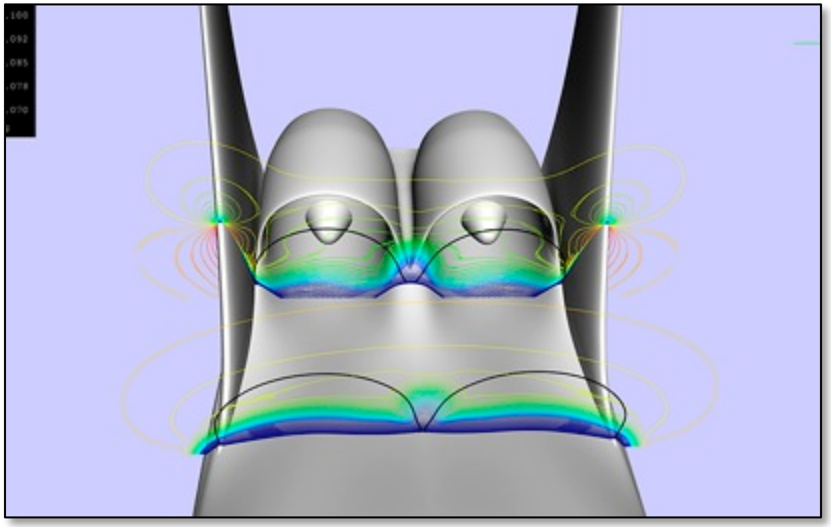
POC: Richard Klein, rklein@astron.berkeley.edu, (925) 422-3548, University of California, Berkeley; Lawrence Livermore National Laboratory

** HECC provided supercomputing resources and services in support of this work*

NASA-MIT 'Double Bubble' Studies Aim to Revolutionize Passenger Aircraft Design *

- Researchers in the NAS Division and the Massachusetts Institute of Technology (MIT) combined wind tunnel tests with CFD simulations run on Pleiades to investigate the potential benefits of the D8 aircraft design.
- The revolutionary D8 configuration, featuring a two-tube "double bubble" fuselage and two vertical stabilizers, relies on boundary layer ingestion (BLI) technology to redirect the thin layer of slower air next to the fuselage surface.
  - The team conducted an experiment in the 14- by 22-foot wind tunnel at NASA Langley using a 1:11 scale model of the D8; and ran the same test on a modified D8 configuration that mimicked a conventional business jet.
  - A grid for just half of the BLI configuration consists of about 166 million grid points; one computational run at one flight condition and one engine power setting required about 25K processor-hours on Pleiades.
  - Computational results show that at low speeds (70–120 mph), the BLI configuration burns 5–9 % less fuel compared to a conventional configuration.
  - If this benefit can be demonstrated at higher speeds, then future aircraft may be able to fly using 60% of the fuel used during each flight of a current aircraft.
- The NASA-MIT team will redesign the aircraft to be efficient at higher speeds, and assess the BLI benefit at 537–650 mph to do trade studies of fuel efficiency versus speed.

Mission Impact: Major advances in aircraft designs to reduce fuel usage, emissions, and noise, require accurate simulation of complex aerodynamic forces—which in turn require the computational capability and capacity of systems like the Pleiades supercomputer.



The shape of the rear fuselage of an MIT D8 aircraft is designed so that a large amount of air going into the engine fan is much slower than what a conventional engine would ingest into the engine. The ingestion of slower air results in substantial fuel savings. *Timothy Sandstrom, NASA/Ames*

POC: Shishir Pandya, shishir.pandya@nasa.gov (650) 604-3981, NASA Ames Research Center

* *HECC provided supercomputing resources and services in support of this work*

HECC Facility Hosts Several Visitors and Tours in November 2015

- HECC hosted 4 tour groups in November. Guests learned about the agency-wide missions being supported by HECC assets; some groups also viewed the D-Wave 2X quantum computing system. Visitors this month included:
  - Congressman Mike Honda visited NAS facility to discuss NASA Earth Exchange research.
  - 16 members of the European Union Trade Counselors, who were the guests of ARC management.
  - 30 NASA Human Resource Directors, who were at ARC for their annual meeting and Labor Management Forum, visited the facility as part of a center tour.
  - Mark Walther, Chief Operating Officer and Officer for the Federal Retirement Thrift Investment Board, along with additional members of the board, received a tour and overview as part of a center tour.

HECC's Nick Bonifas gives a tour to NASA human resource directors, taking them through the main supercomputing room at the NASA Advanced Supercomputing facility.

POC: Gina Morello, gina.f.morello@nasa.gov, (650) 604-4462, NASA Advanced Supercomputing Division

Papers

- “**A Fifth-Order Finite Difference Scheme for Hyperbolic Equations on Block-Adaptive Curvilinear Grids**,” Y. Chen, G. Toth, T. Gombosi, Journal of Computational Physics, vol. 305, Nov. 4, 2015. *
http://www.sciencedirect.com/science/article/pii/S0021999115007378
- “**Numerical Simulations of Sunspot Decay: On the Penumbra—Evershed Flow—Moat Flow Connection**,” M. Rempel, arXiv:1511.01410 [astro-ph.SR], Nov. 4, 2015. *
http://arxiv.org/abs/1511.01410
- “**Multifluid MHD Study of the Solar Wind Interaction with Mars’ Upper Atmosphere During the 2015 March 8th ICME Event**,” C. Dong, et al., Geophysical Research Letters, Nov. 5, 2015. *
http://onlinelibrary.wiley.com/doi/10.1002/2015GL065944/full
- “**A Comparison of 3D Model Predictions of Mars’ Oxygen Corona with Early MAVEN IUVS Observations**,” Y. Lee, et al., Geophysical Research Letters, Nov. 5, 2015. *
http://onlinelibrary.wiley.com/doi/10.1002/2015GL065291/full
- “**Inflow Generated X-Ray Corona Around Supermassive Black Holes and Unified Model for X-Ray Emission**,” L. Wang, R. Cen, arXiv:1511.02890 [astro-ph.GA], Nov. 9, 2015. *
http://arxiv.org/abs/1511.02890

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Papers (cont.)

- "**Evolution of Global Relativistic Jets: Collimations and Expansion with kKHI and the Weibel Instability**," K. Nishikawa, et al., arXiv:1511.03581 [astro-ph.HE], Nov. 11, 2015.*
  http://arxiv.org/abs/1511.03581
- "**Giant Impacts on Earth-Like Worlds**," E. Quintana, et al., arXiv:1511.03663 [astro-ph.EP], Nov. 11, 2015. *
  http://arxiv.org/abs/1511.03663
- "**Implementation of Warm-Cloud Processes in a Source-Oriented WRF/Chem Model to Study the Effect of Aerosol Mixing State on Fog Formation in the Central Valley of California**," H.-H. Lee, et al., Atmospheric Chemistry and Physics: Discussions, Nov. 17, 2015. *
  http://www.atmos-chem-phys-discuss.net/15/32239/2015/acpd-15-32239-2015.html
- "**Hot Oxygen Corona at Mars and the Photochemical Escape of Oxygen: Improved Description of the Thermosphere, Ionosphere, and Exosphere**," Y. Lee, et al., Journal of Geophysical Research: Planets, Nov. 24, 2015. *
  http://onlinelibrary.wiley.com/doi/10.1002/2015JE004890/full
- "**Velocities of Warm Galactic Outflows from Synthetic Halpha Observations of Star-Forming Galaxies**," D. Ceverino, S. Arribas, L. Colina, B. Del Pino, A. Dekel, J. Primack, arXiv:1511.07653 [astro-ph.GA], Nov. 24, 2015. *
  http://arxiv.org/abs/1511.07653

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Presentations

- **2015 Supercomputing Conference**, November 15–20, 2015, Austin, Texas
  - “**System-Level Assessment of New Technologies to Reduce Airframe Noise**,” M. Khorrami *
    http://www.nas.nasa.gov/SC15/demos/demo1.html
  - “**Transforming Passenger Aircraft for Fuel Efficiency**,” S. Pandya *
    http://www.nas.nasa.gov/SC15/demos/demo2.html
  - “**Numerical Simulation of Slat Noise to Support Environmentally Responsible Aviation**,” J. Housman *
    http://www.nas.nasa.gov/SC15/demos/demo3.html
  - “**Studying the Aerodynamics of Multi-Rotor Drones**,” S. Yoon *
    http://www.nas.nasa.gov/SC15/demos/demo4.html
  - “**Improved Resolution of Rotorcraft Flows Using Adaptive Mesh Refinement**,” N. Chaderjian *
    http://www.nas.nasa.gov/SC15/demos/demo5.html
  - “**High-Fidelity Physics-Based Analysis and Design of Complex Configurations**,” K. Anderson *
    http://www.nas.nasa.gov/SC15/demos/demo6.html
  - “**Sensitivity Analysis for Chaotic Fluid Simulations**,” E. Nielsen *
    http://www.nas.nasa.gov/SC15/demos/demo7.html
  - “**Computational Aeroacoustic Open-Rotor Simulations for Green Aviation**,” M. Barad *
    http://www.nas.nasa.gov/SC15/demos/demo8.html
  - “**Using Distributed Flaps to Optimize Flexible Wings During Flight**,” M. Aftosmis *
    http://www.nas.nasa.gov/SC15/demos/demo9.html
  - “**Simulating the SLS Ignition Over-Pressure/Sound Suppression Water System**,” J. West *
    http://www.nas.nasa.gov/SC15/demos/demo10.html

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Presentations (cont.)

- **2015 Supercomputing Conference (cont.)**
  - "**Assessing Liquid Rocket Engine Feed Line Flow for the Space Launch System**," A. Mulder *
    http://www.nas.nasa.gov/SC15/demos/demo11.html
  - "**Predicting Baffled Propellant Tank Slosh for Spacecraft**," H. Q. Yang *
    http://www.nas.nasa.gov/SC15/demos/demo12.html
  - "**Analyzing the Space Launch System Debris Environment**," B. Williams *
    http://www.nas.nasa.gov/SC15/demos/demo13.html
  - "**Building the Space Launch System Booster Separation Database**," S. Rogers *
    http://www.nas.nasa.gov/SC15/demos/demo14.html
  - "**Designing a New Spacecraft for Deep Space Exploration**," C. Tang *
    http://www.nas.nasa.gov/SC15/demos/demo15.html
  - "**Ensuring Safe Passage of the Space Launch System Through the Speed of Sound**," S. Alter *
    http://www.nas.nasa.gov/SC15/demos/demo16.html
  - "**Simulating Star Formation: From Giant Molecular Clouds to Protostellar Clusters**," R. Klein *
    http://www.nas.nasa.gov/SC15/demos/demo17.html
  - "**Discovering How Galaxies Form: Comparing Simulations with Hubble Images**," J. Primack *
    http://www.nas.nasa.gov/SC15/demos/demo18.html
  - "**Projecting Sea Level Rise by Modeling the Evolution of Ice Sheets**," G. Perez *
    http://www.nas.nasa.gov/SC15/demos/demo19.html
  - "**Using Katrina and Sandy Data to Improve Hurricane Prediction Tools**," B.-W. Shen *
    http://www.nas.nasa.gov/SC15/demos/demo20.html

** HECC provided supercomputing resources and services in support of this work*

Presentations (cont.)

- **2015 Supercomputing Conference (cont.)**
  - "**Predicting Damage for an Asteroid Strike on Earth**," D. Robertson *
    http://www.nas.nasa.gov/SC15/demos/demo21.html
  - "**Building Petabyte Data Production Systems with the NASA Earth Exchange**," P. Votava *
    http://www.nas.nasa.gov/SC15/demos/demo22.html
  - "**Test-Driving the 'Sun in a Box' with NASA's IRIS Solar Observatory**," M. Carlsson *
    http://www.nas.nasa.gov/SC15/demos/demo23.html
  - **Unlocking the Secrets of Solar Storms**," R. Caplan *
    http://www.nas.nasa.gov/SC15/demos/demo24.html
  - "**HECC—Moving to the Future, Today**," W. Thigpen
    http://www.nas.nasa.gov/SC15/demos/demo25.html
  - "**A Dual Path to Adaptive Mesh Refinement Visualizations**," P. Moran
    http://www.nas.nasa.gov/SC15/demos/demo26.html
  - "**Recent Progress in NASA's Quantum Computing Research Project**," A. Perdomo-Ortiz
    http://www.nas.nasa.gov/SC15/demos/demo27.html *
  - "**Optimizing Code for NASA's High-Performance Computing Systems**," R. Hood
    http://www.nas.nasa.gov/SC15/demos/demo28.html
  - "**Data Assimilation and Image Registration Using Quantum Annealing**," C. Pelissier
    http://www.nas.nasa.gov/SC15/demos/demo35.html *
- "**Automatically Encapsulating HPC Best Practices into Data Transfers**," P. Kolano, presented at HUST 2015, Austin, Texas, Nov. 20, 2015.
  http://dl.acm.org/citation.cfm?id=2834997

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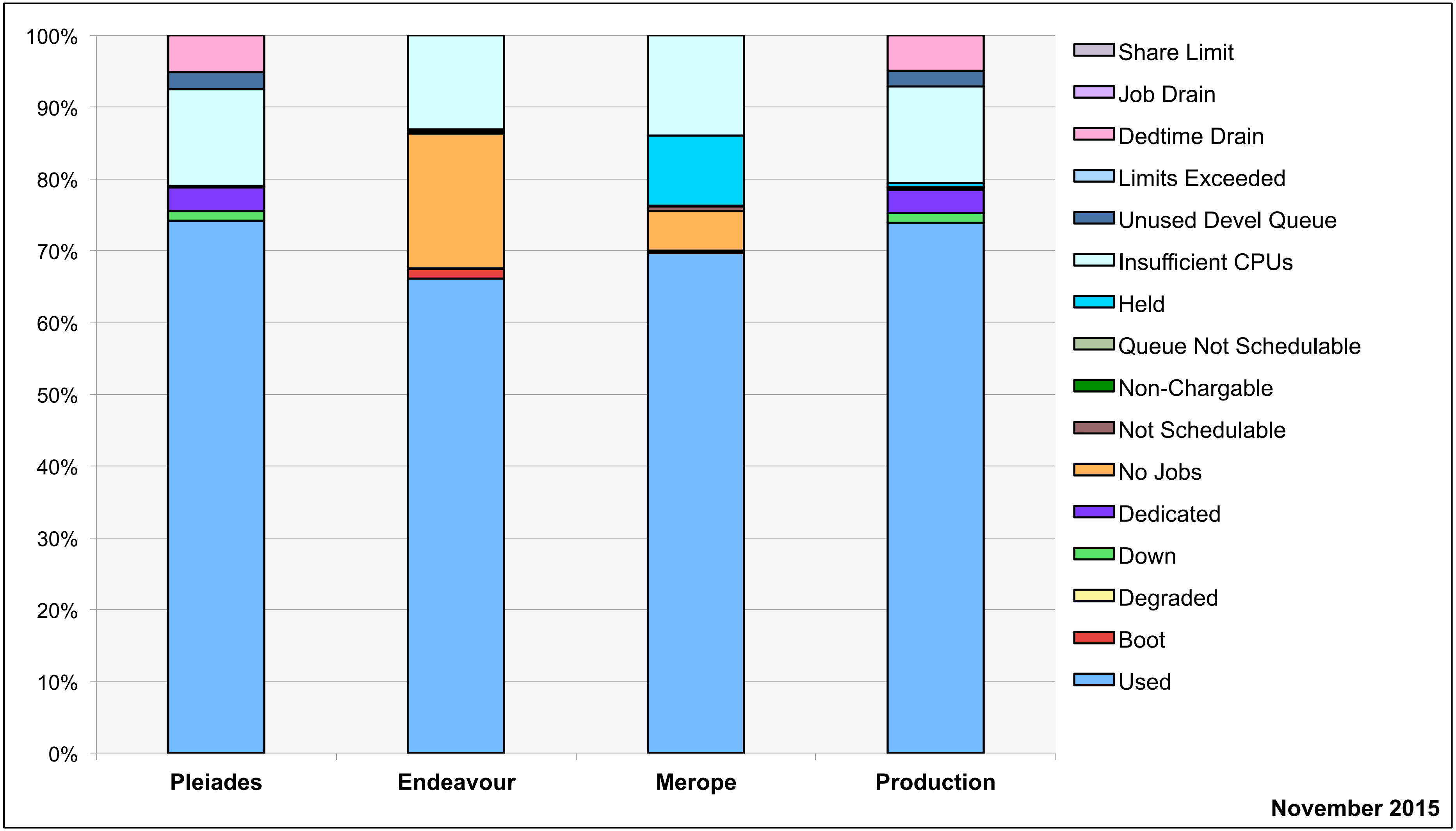
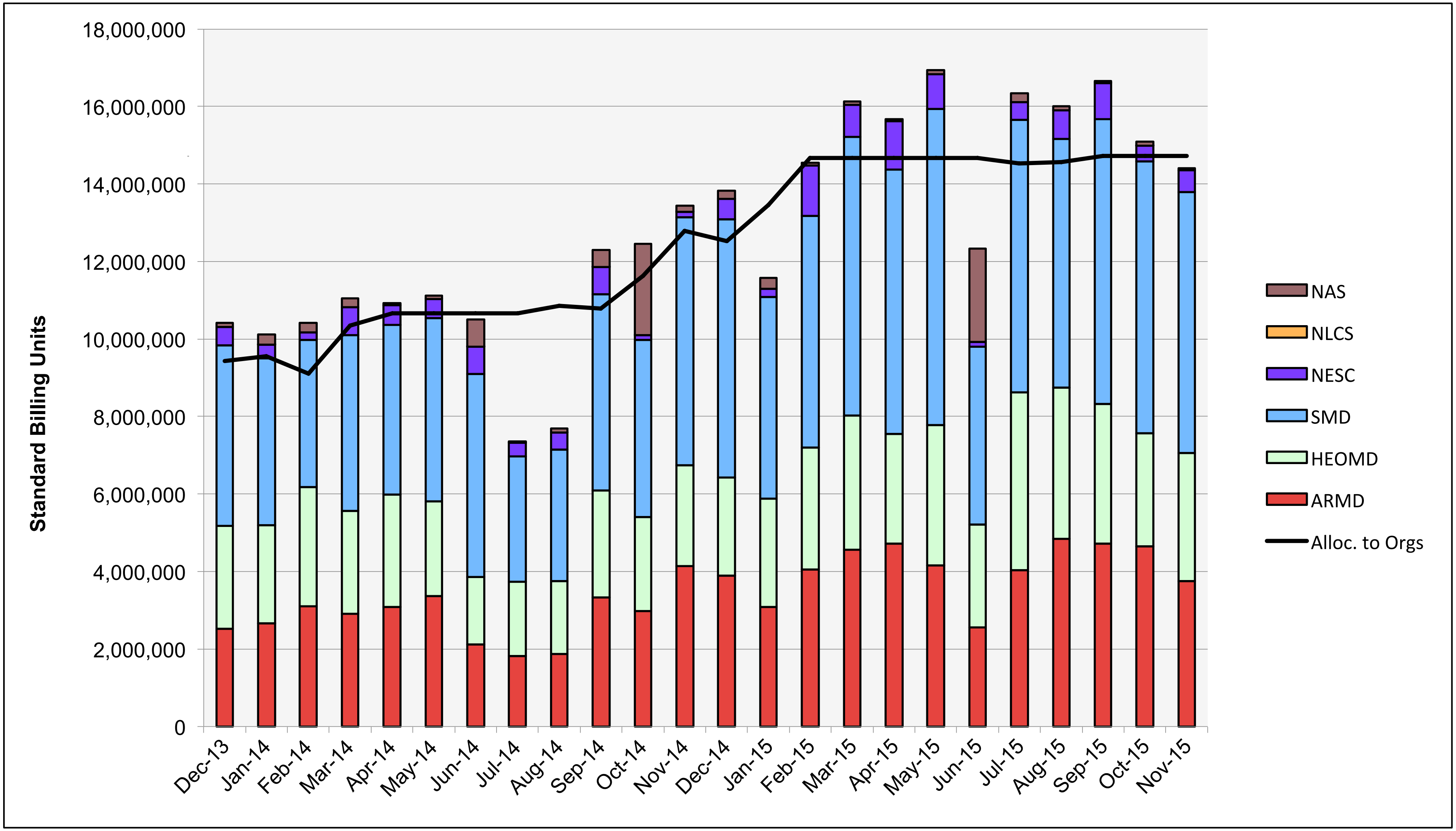
News & Events

- **Capturing a Sleeping Sun**, *NCAR/UCAR AtmosNews*, Nov. 6, 2015—Scientists at NCAR's High Altitude Observatory produced a 3-D magnetohydrodynamic simulation on a NASA supercomputer (Pleiades) to tackle complex turbulent interactions beneath the Sun's surface. Results were published in the Astrophysics Journal.
  https://www2.ucar.edu/atmosnews/just-published/17743/capturing-sleeping-sun
- **NASA Experts Share Importance of Supercomputing at Annual Conference**, *NASA media advisory*, Nov. 12, 2015—A preview of NASA's participation in SC15 in Austin, where scientists and engineers showcased mission projects that benefit from the agency's high-performance computers.
  http://www.nasa.gov/ames/press-release/nasa-experts-share-importance-of-supercomputing-at-annual-conference
- **Simulating SLS Booster Separation**, *NASA Ames image feature*, Nov. 19, 2015—Researchers at the NASA Advanced Supercomputing (NAS) Division delivered a complex aerodynamics database for the Space Launch System's booster separation event, and presented some of their work at the 2015 Supercomputing Conference in Austin, Texas.
  https://www.nasa.gov/ames/image-feature/simulation-sls-booster-separation
  - **How NASA Engineers are Designing the Aerodynamics of Its New Heavy-Lift Launcher**, *Gizmodo*, November 20, 2015.
    http://gizmodo.com/how-nasa-engineers-are-designing-the-aerodynamics-of-it-1743705943
  - **Simulating SLS Booster Separation**, *Space Daily*, November 22, 2015.
    http://www.spacedaily.com/reports/Simulating_SLS_Booster_Separation_999.html

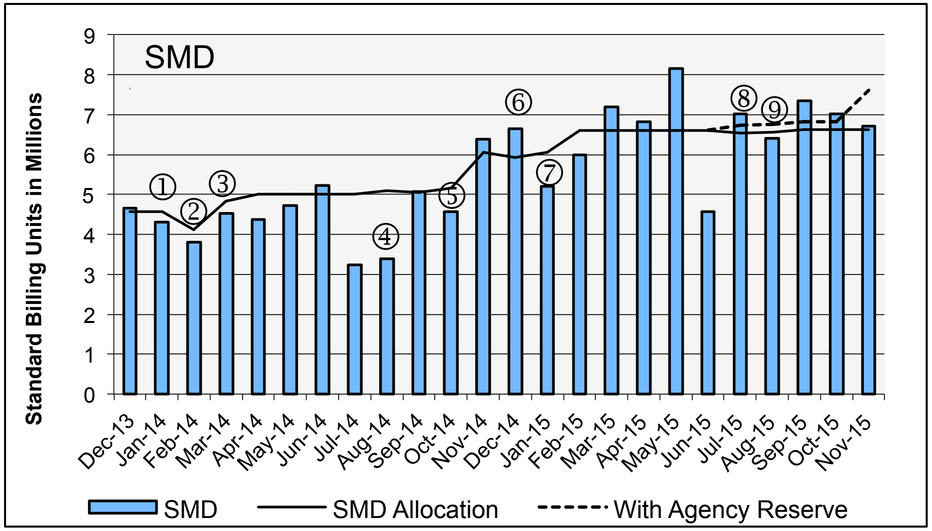
HECC Utilization

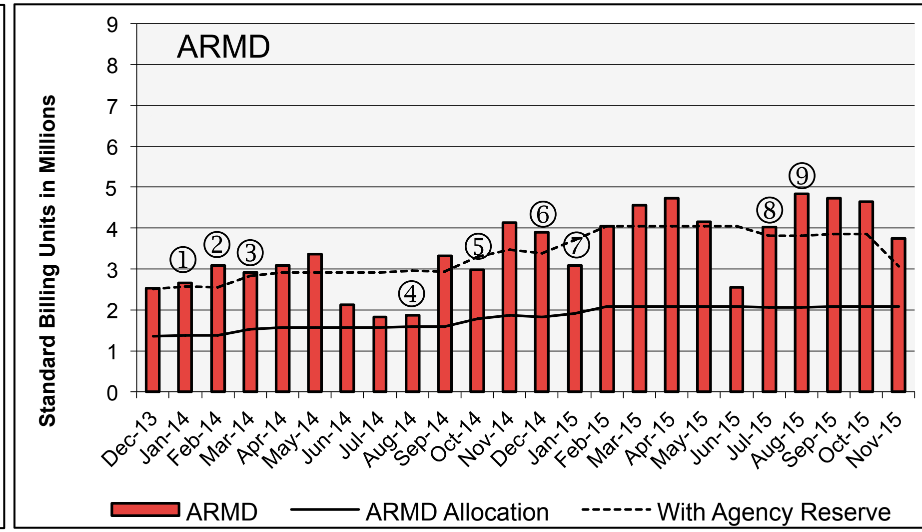


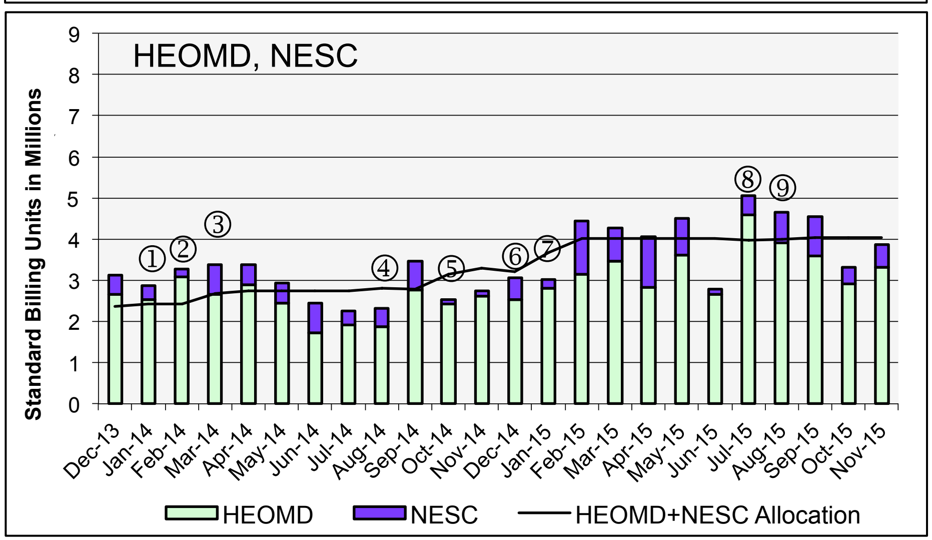
HECC Utilization Normalized to 30-Day Month



HECC Utilization Normalized to 30-Day Month







① 6 Ivy Bridge Racks added; 20 Nehalem, 12 Westmere Racks Retired from Pleiades

② 8 Ivy Bridge Racks added mid-Feb; 8 Ivy Bridge Racks added late Feb to Pleiades

③ 4 Ivy Bridge Racks added mid-March to Pleiades

④ 6 Westmere Racks added to Merope, Merope Harpertown retired

⑤ 16 Westmere Racks retired, 3 Ivy Bridge Racks added, 15 Haswell Racks added to Pleiades; 10 Nehalem Racks and 2 Westmere Racks added to Merope

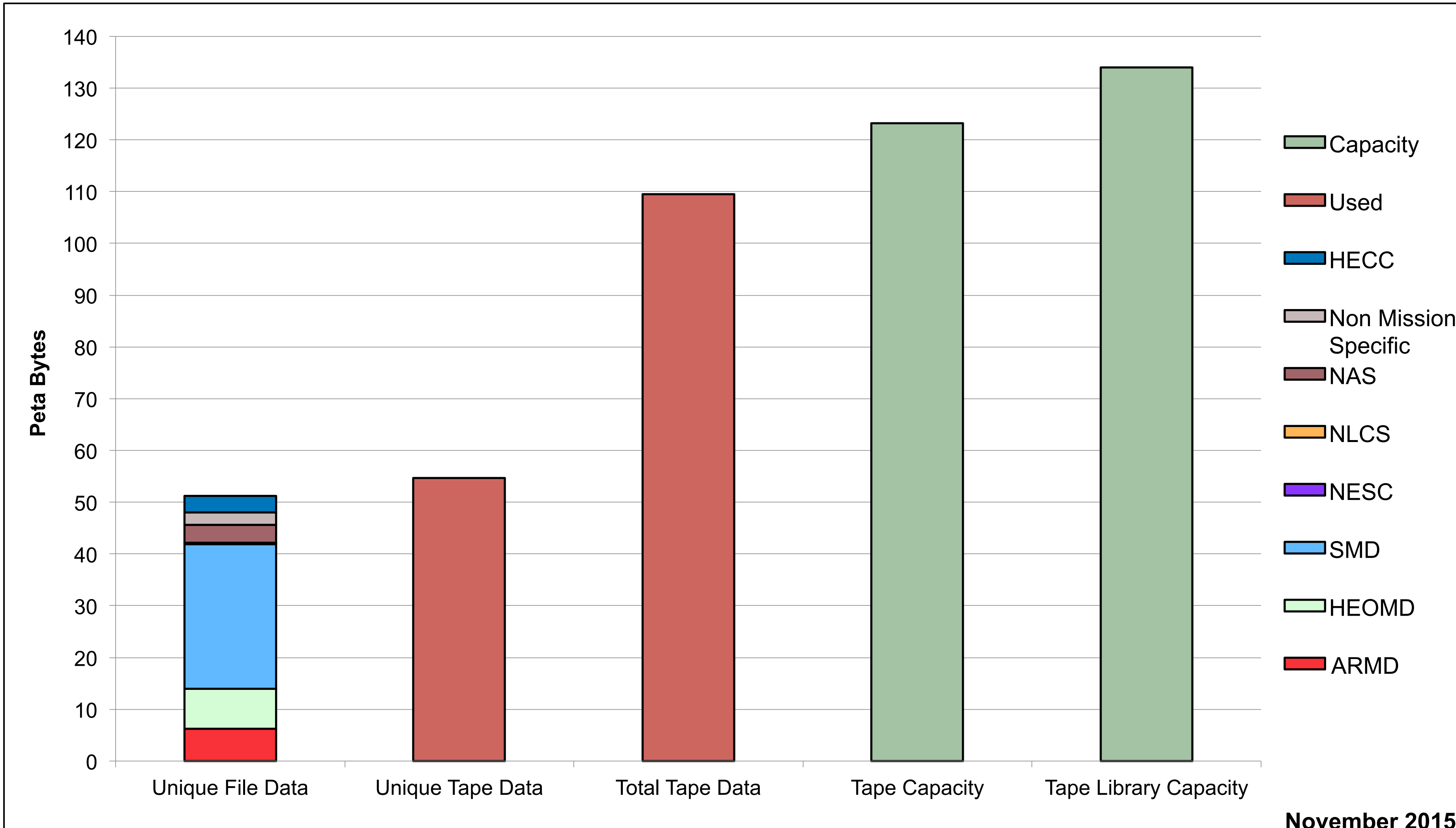
⑥ 16 Westmere Racks retired from Pleiades

⑦ 14 Haswell racks added to Pleiades

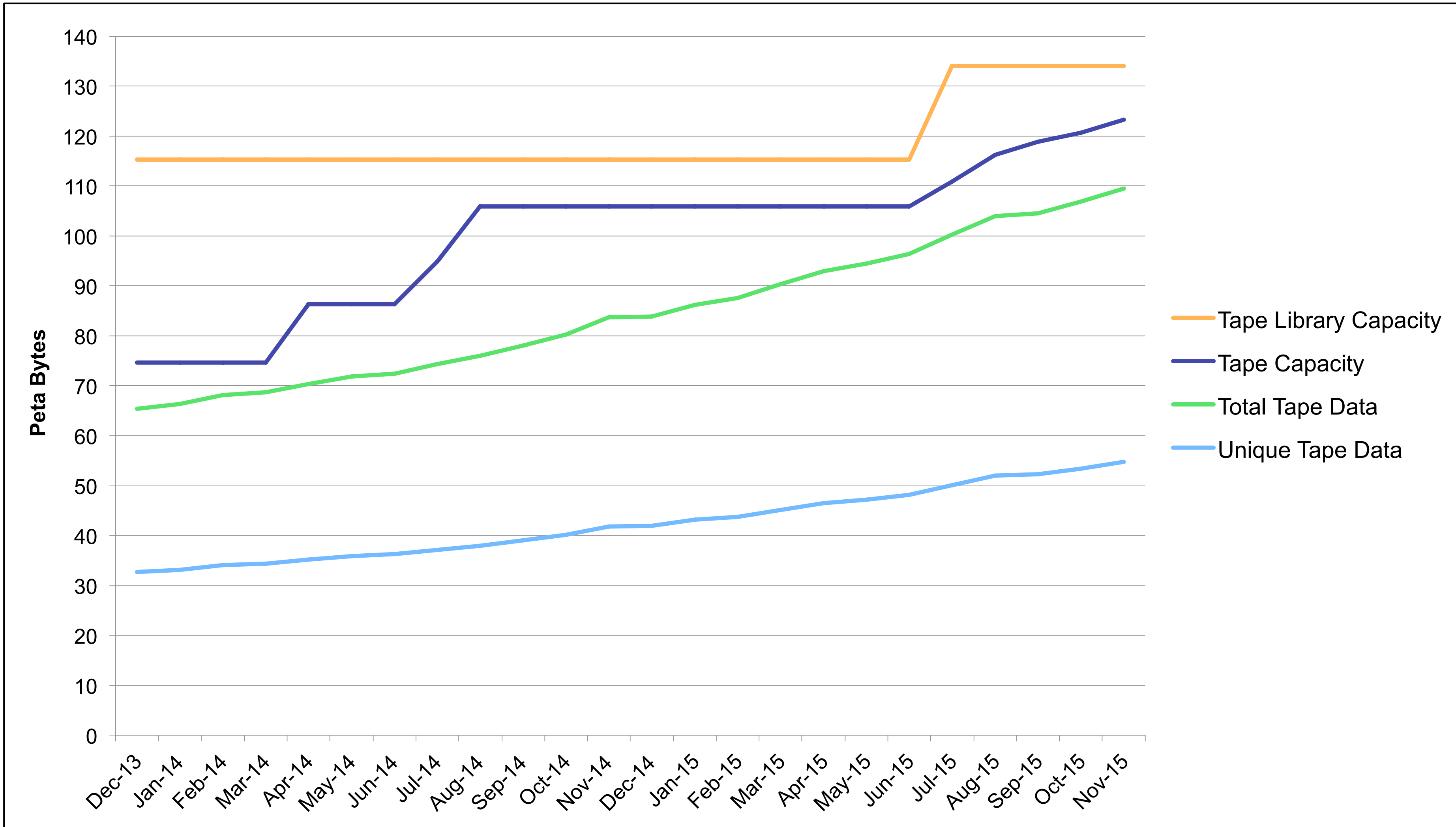
⑧ 7 Merope Nehalem Racks removed from Merope

⑨ 7 Merope Westmere Racks added from Merope

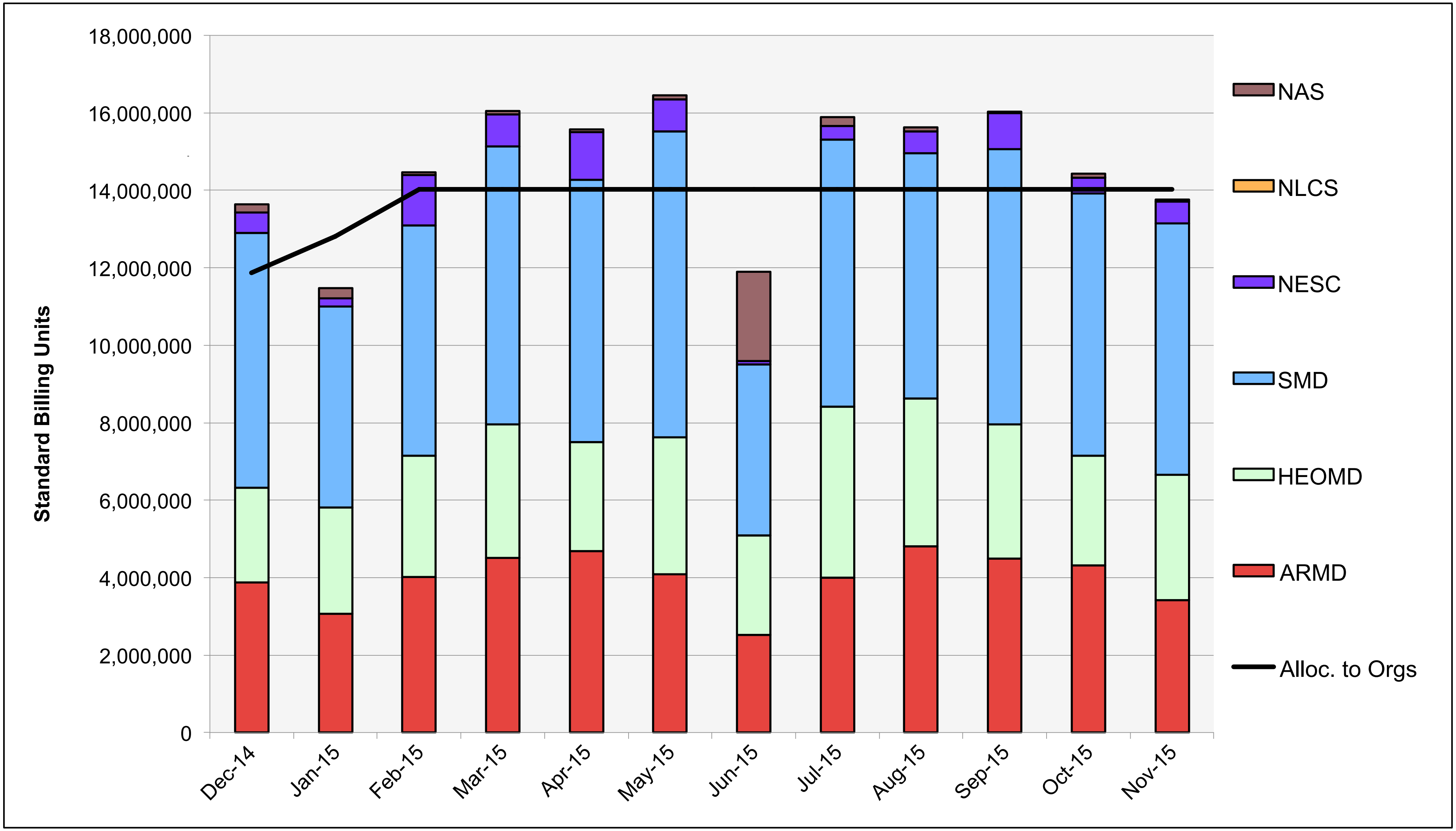
Tape Archive Status



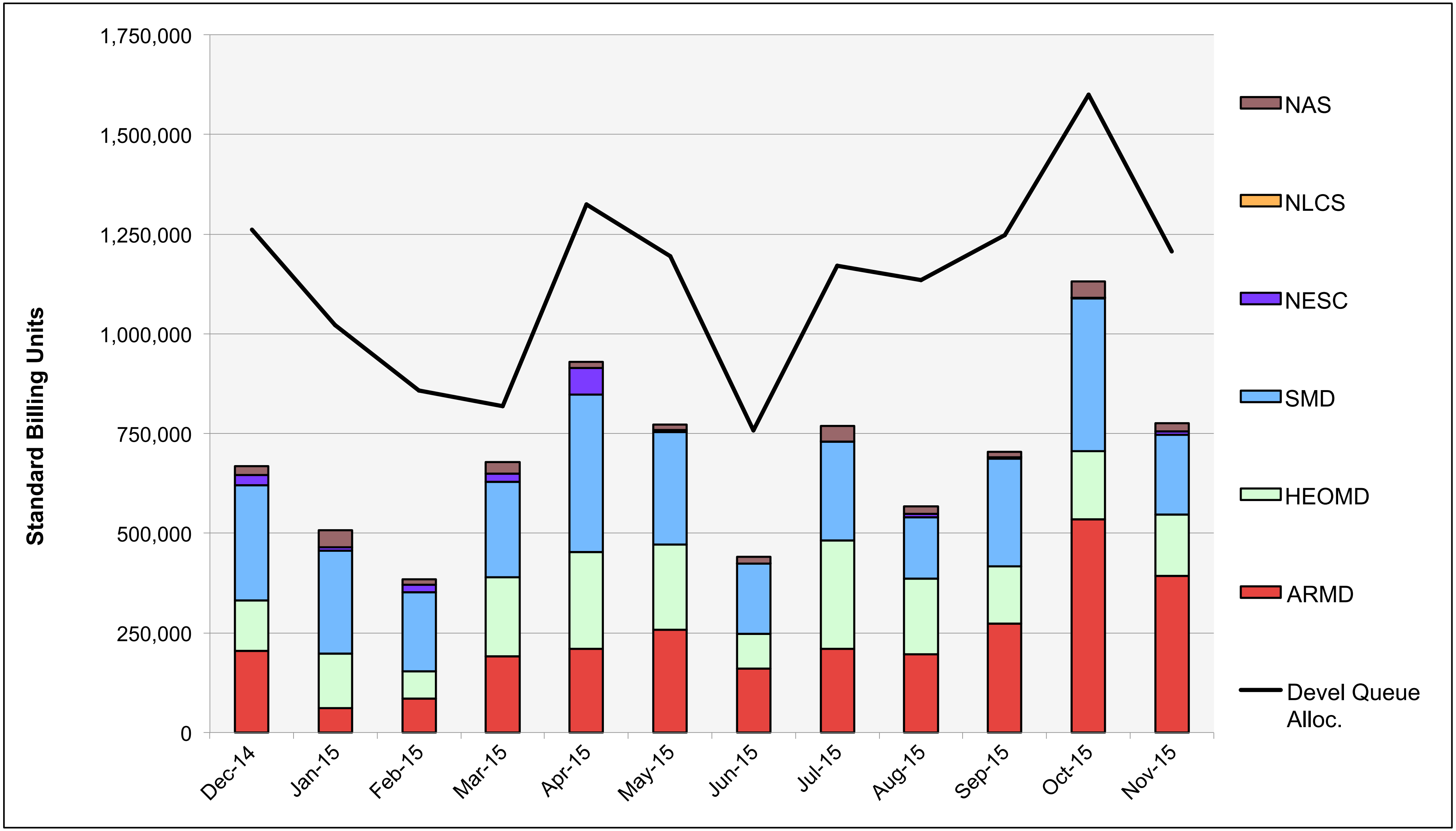
Tape Archive Status



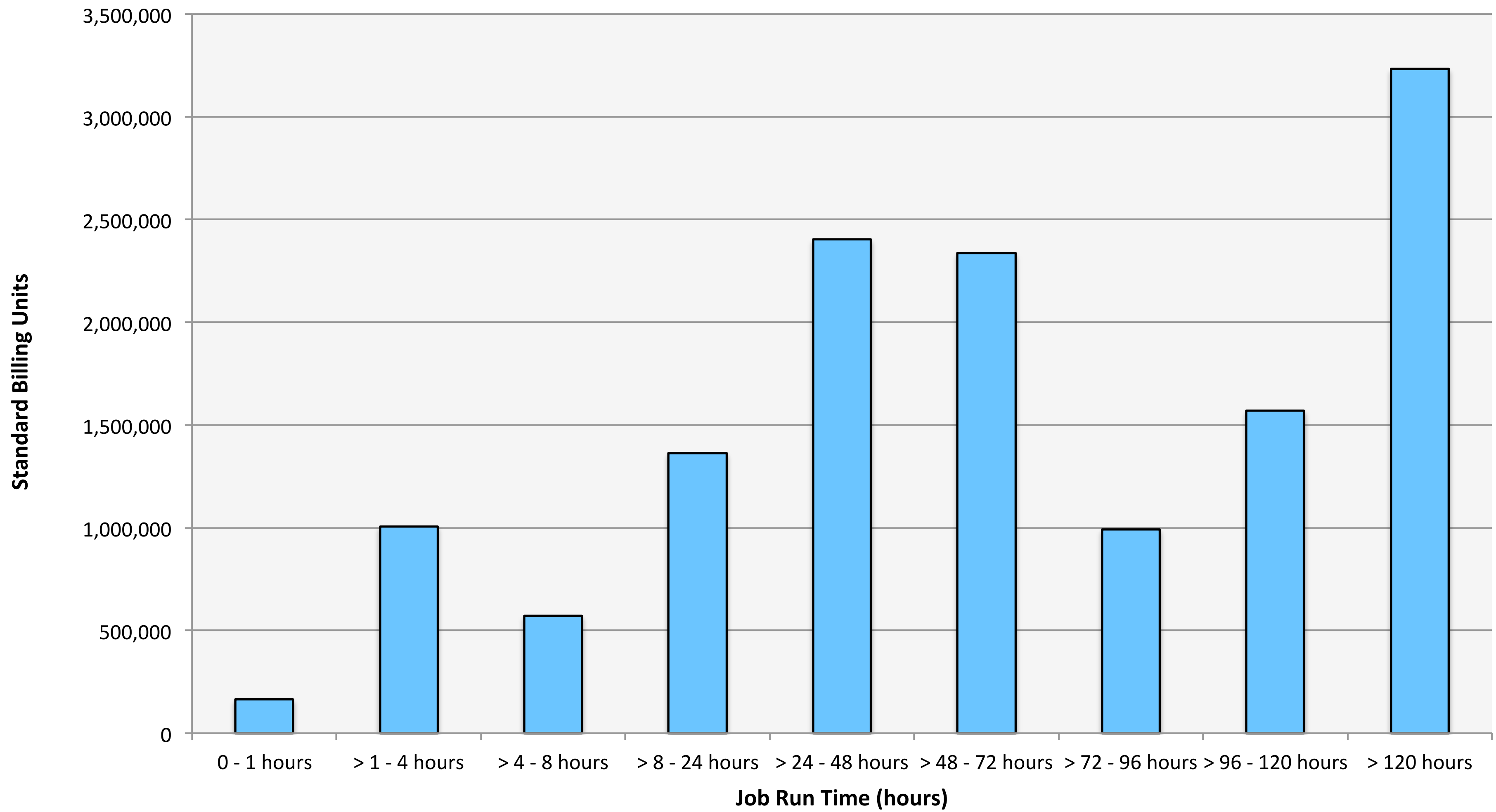
Pleiades:
SBUs Reported, Normalized to 30-Day Month



Pleiades:
Devel Queue Utilization

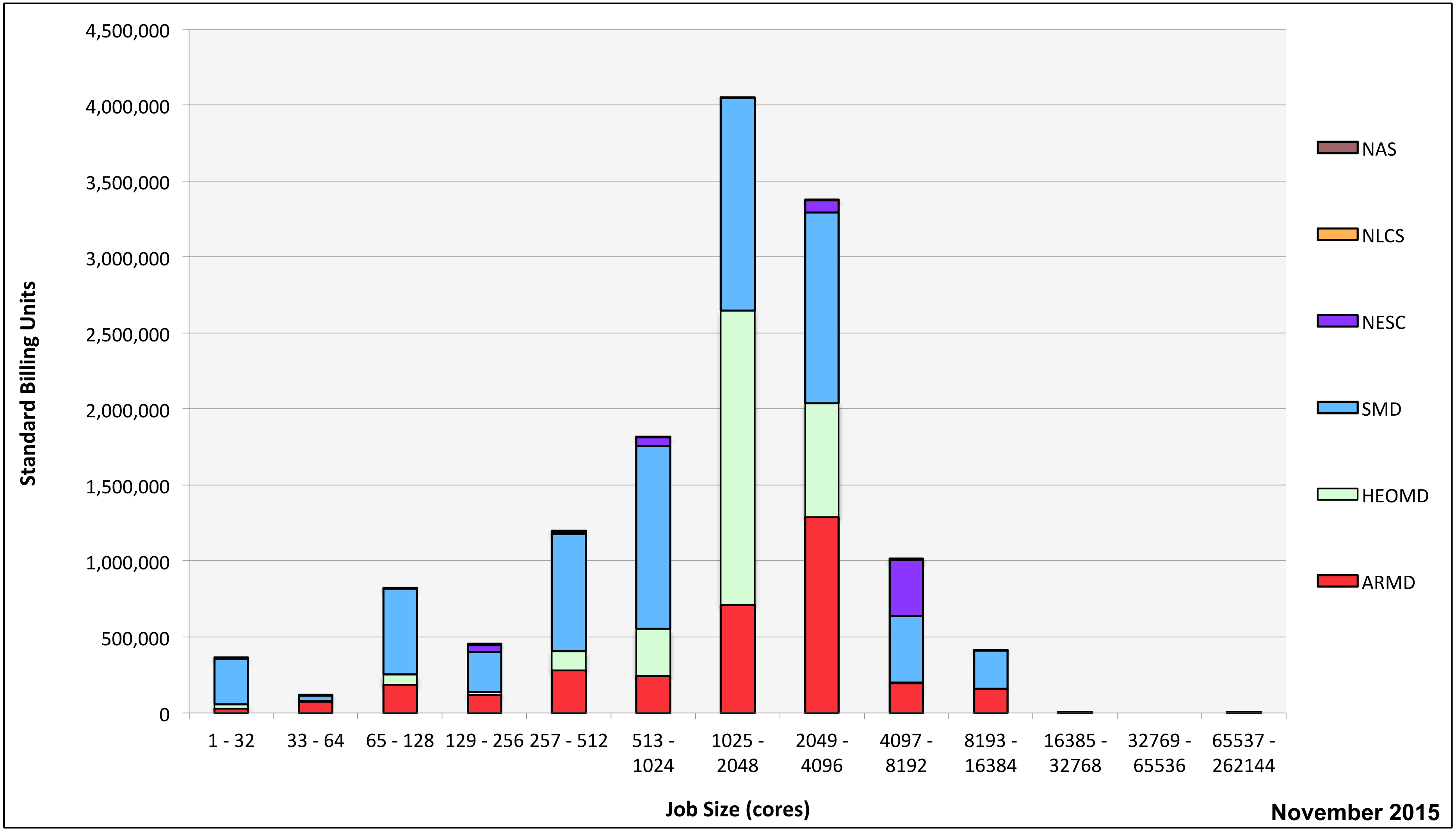


Pleiades: Monthly Utilization by Job Length

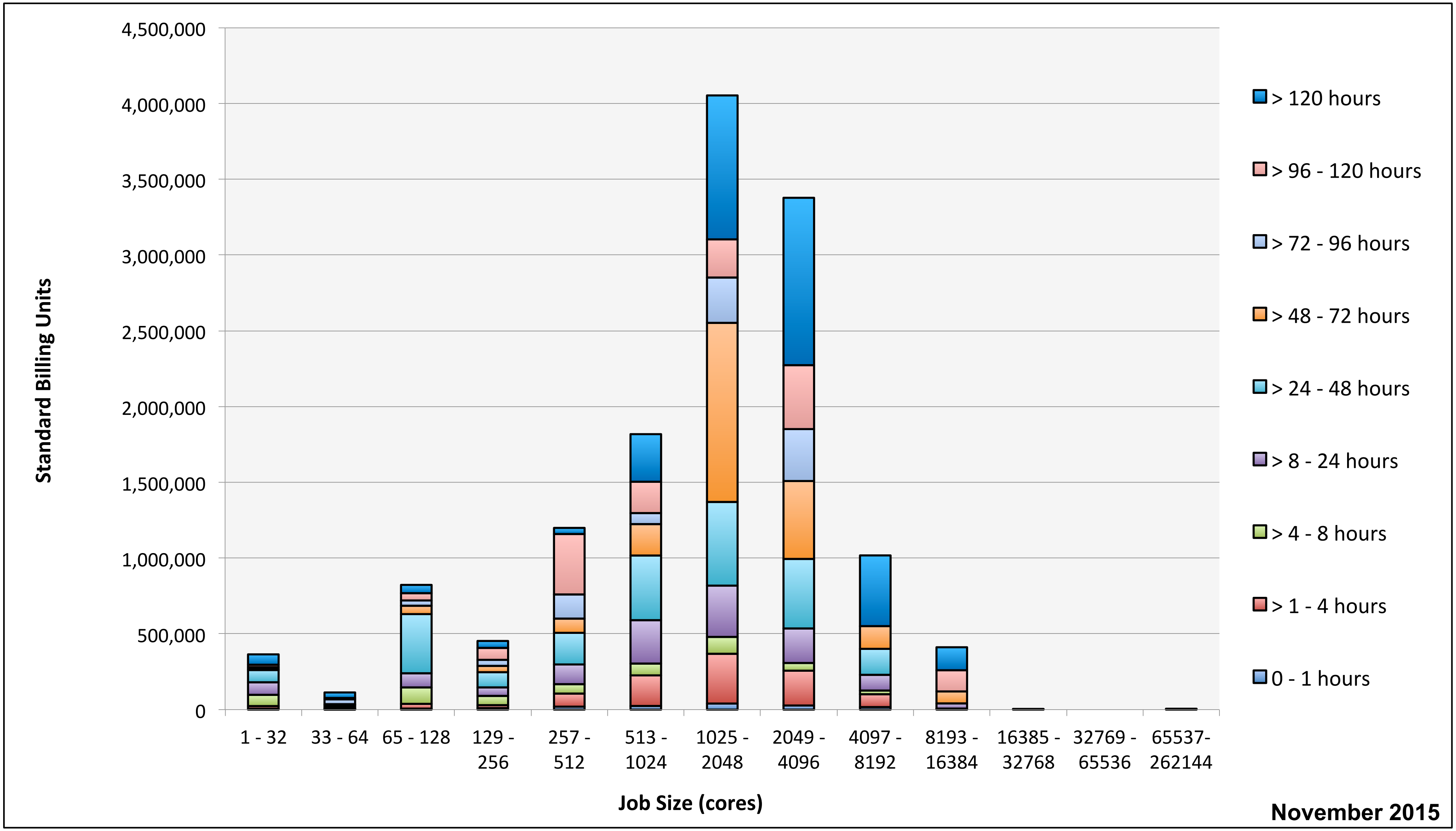


November 2015

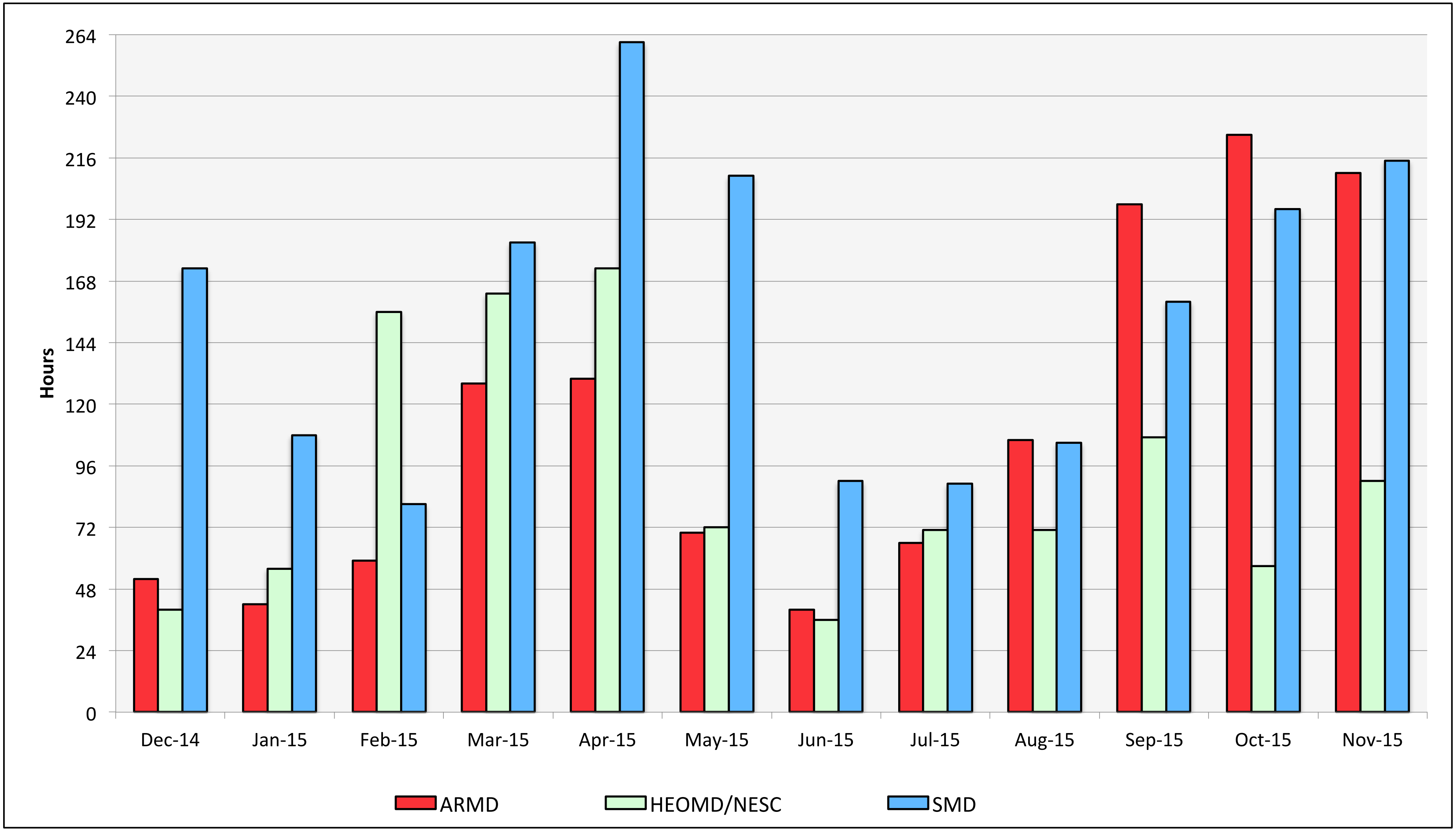
Pleiades:
Monthly Utilization by Size and Mission



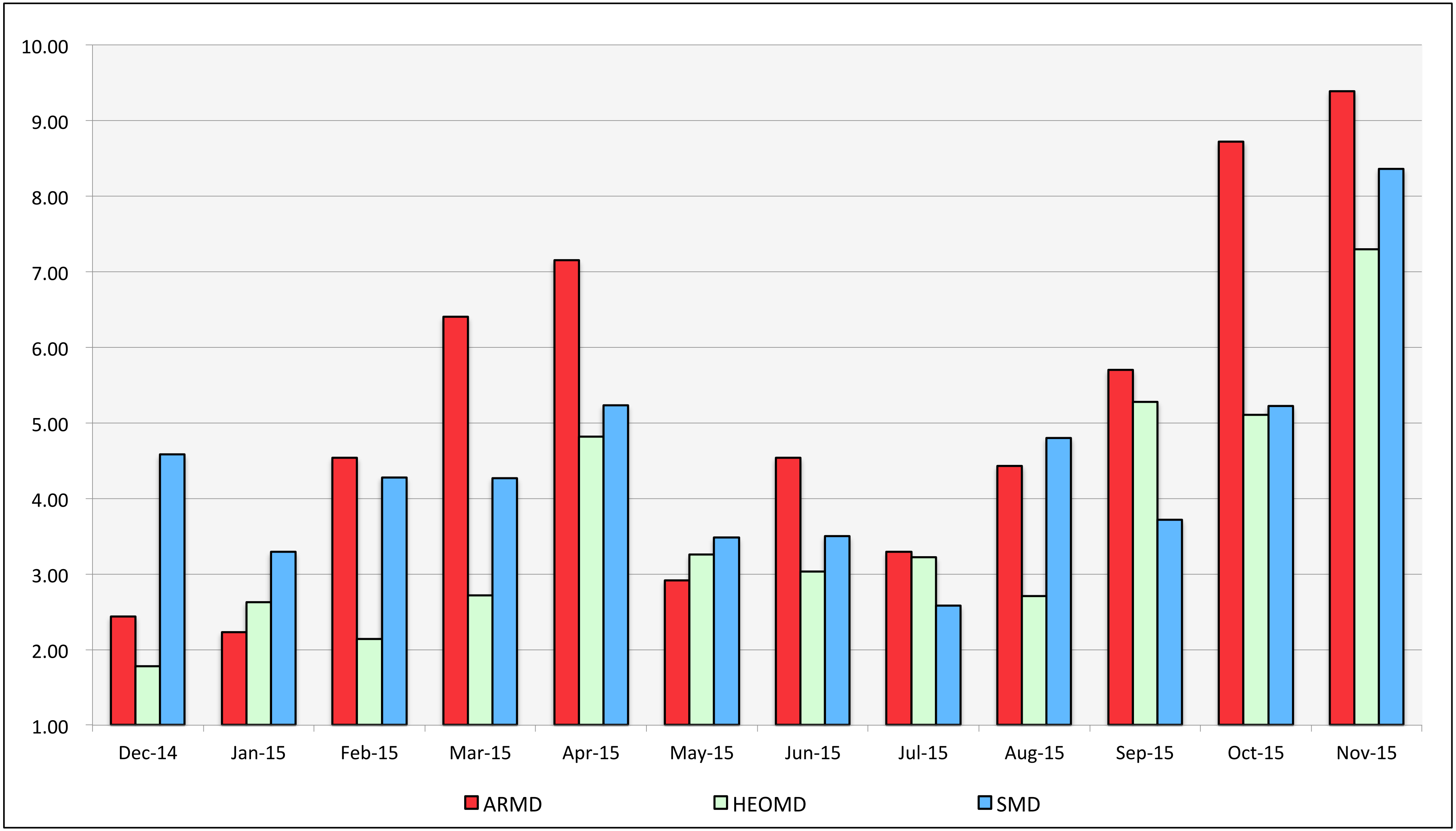
Pleiades: Monthly Utilization by Size and Length



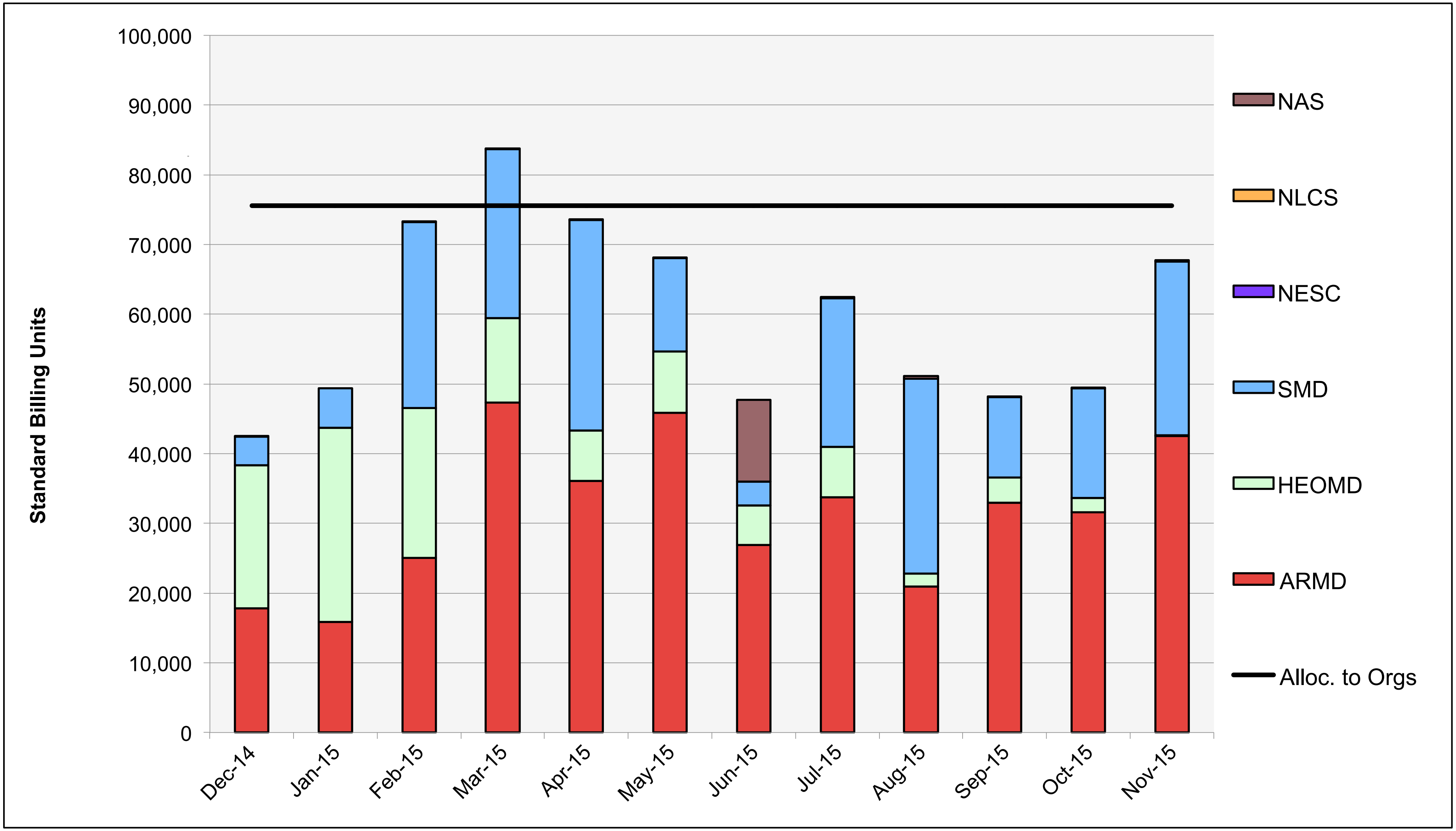
Pleiades:
Average Time to Clear All Jobs



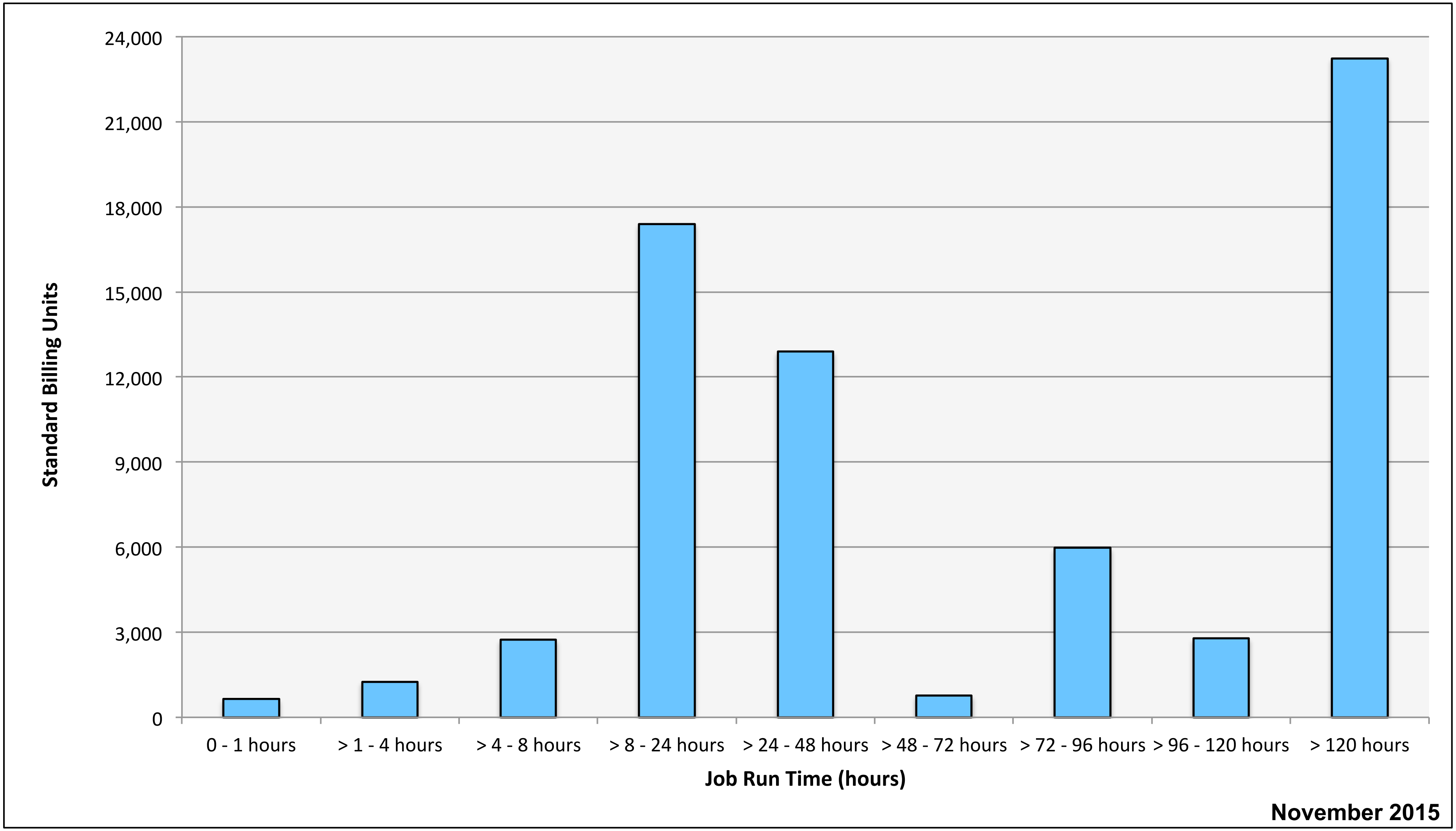
Pleiades: Average Expansion Factor



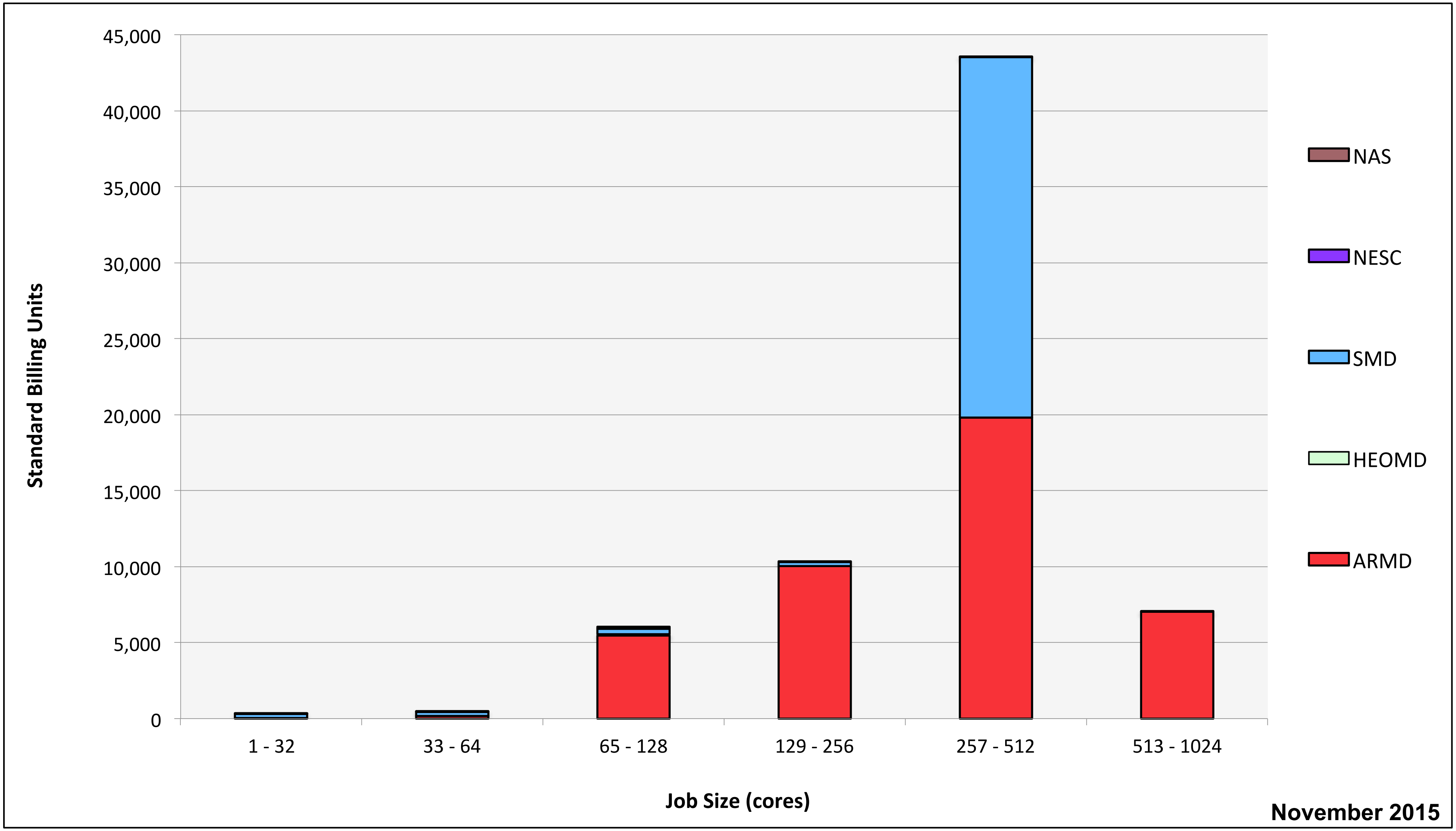
Endeavour: SBUs Reported, Normalized to 30-Day Month



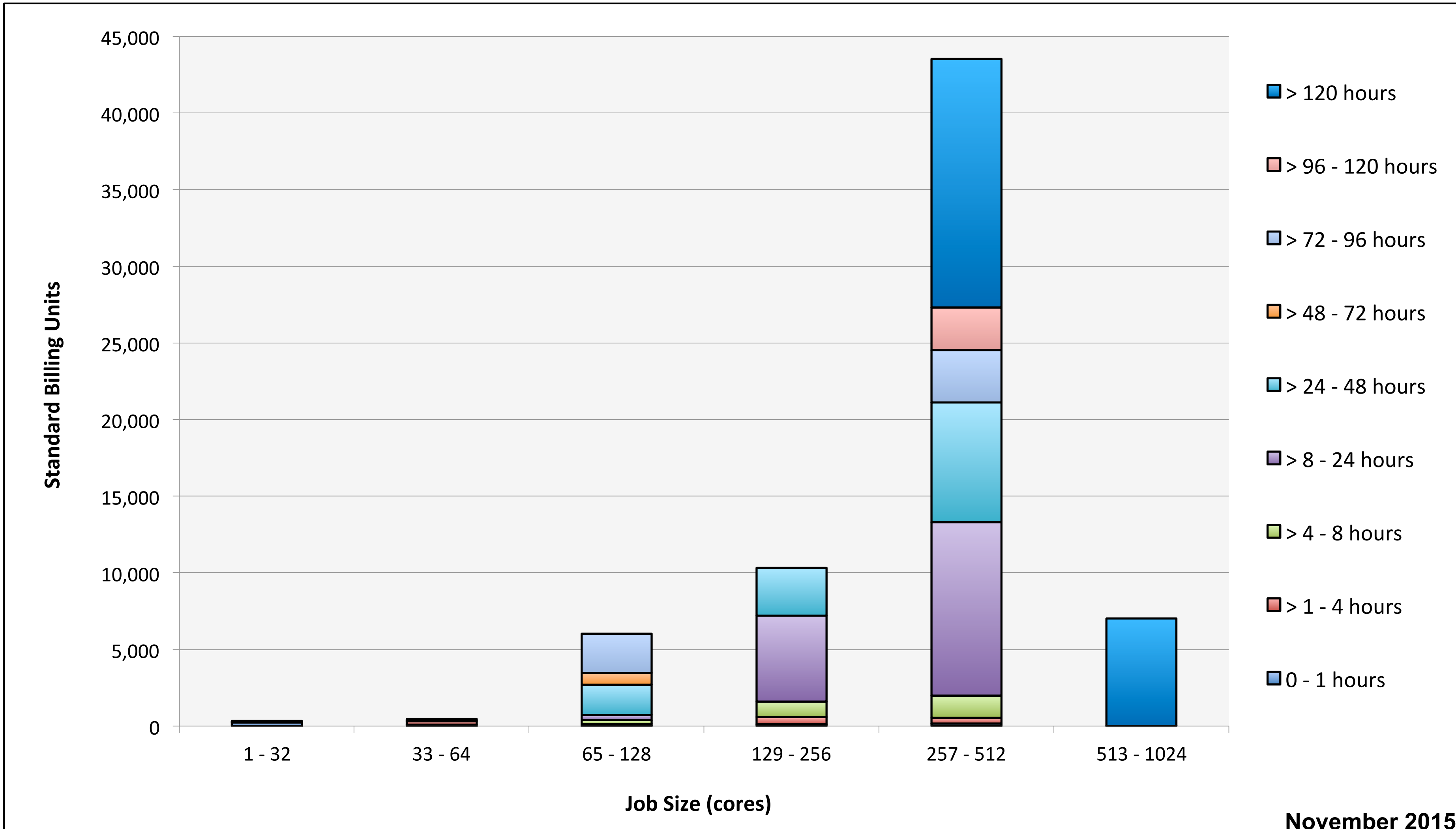
Endeavour:
Monthly Utilization by Job Length



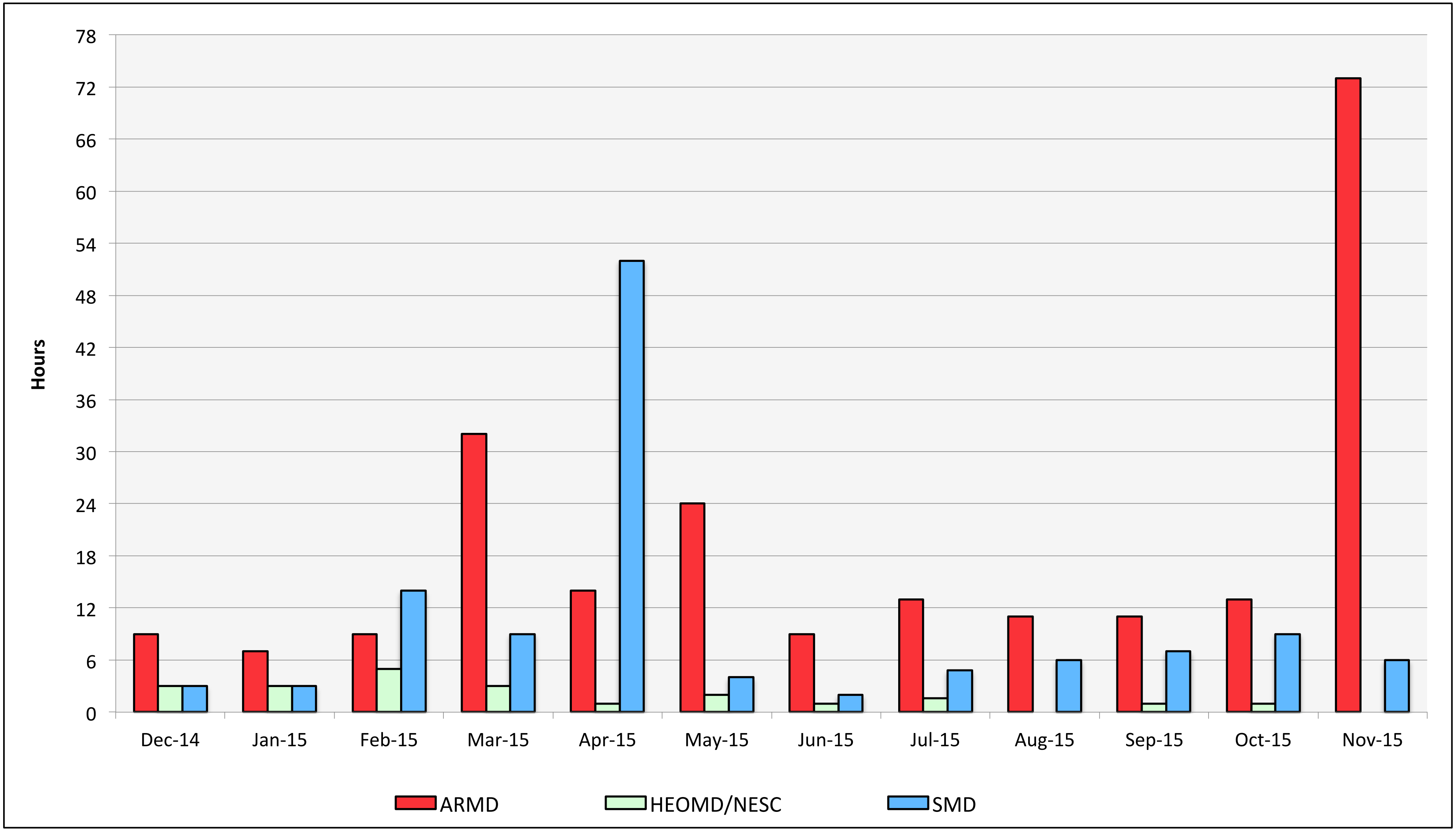
Endeavour: Monthly Utilization by Size and Mission



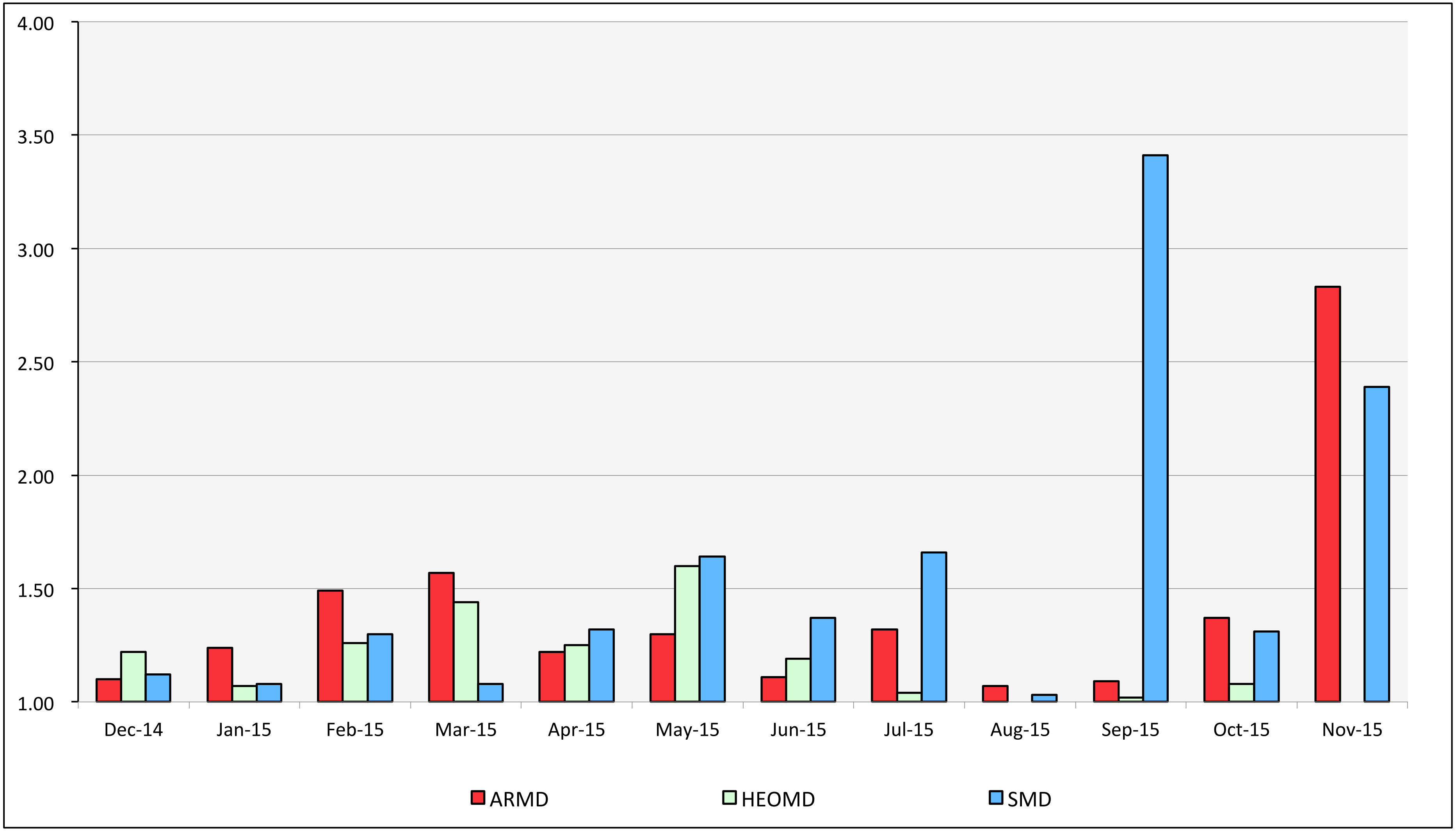
Endeavour: Monthly Utilization by Size and Length



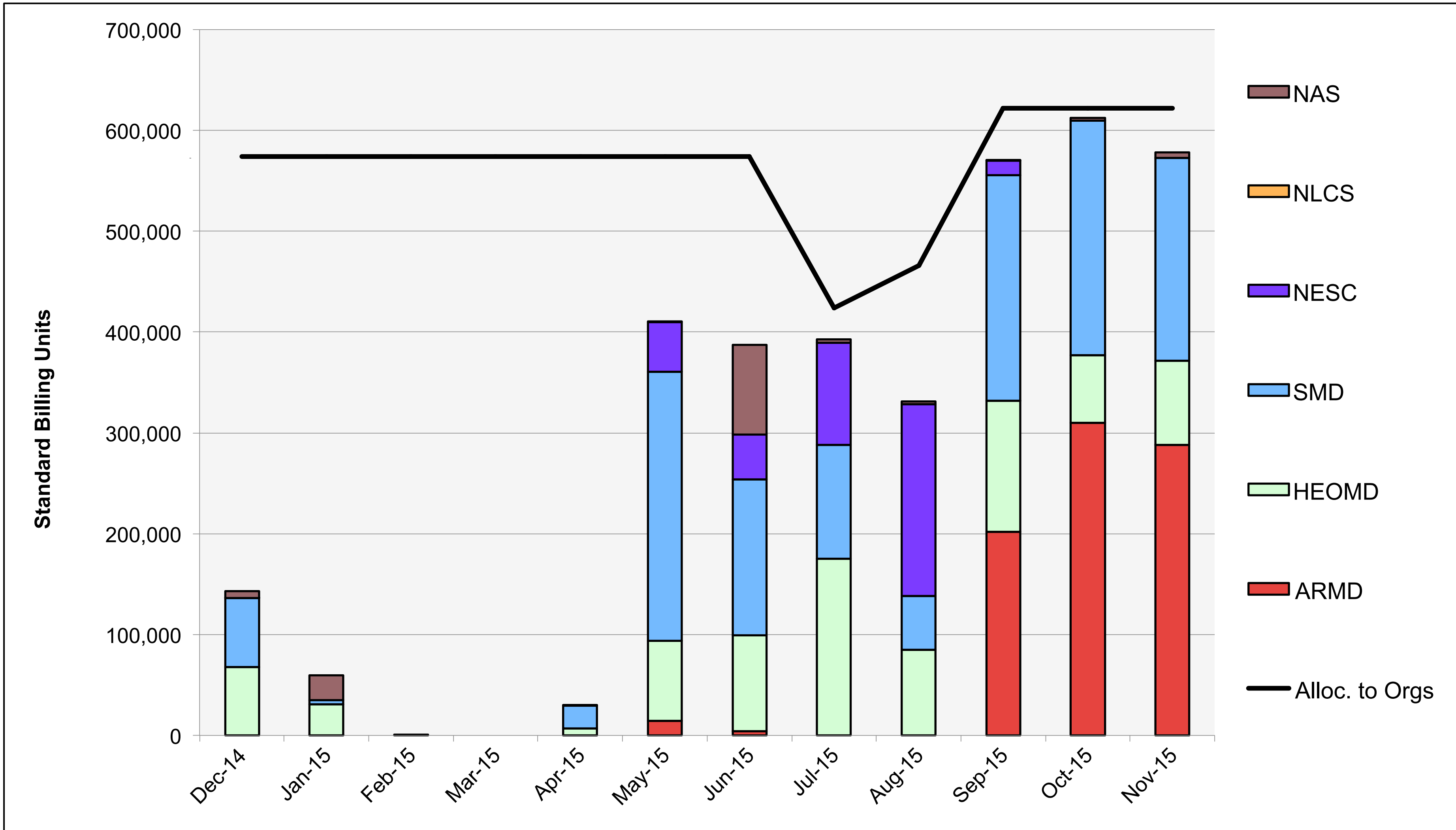
Endeavour: Average Time to Clear All Jobs



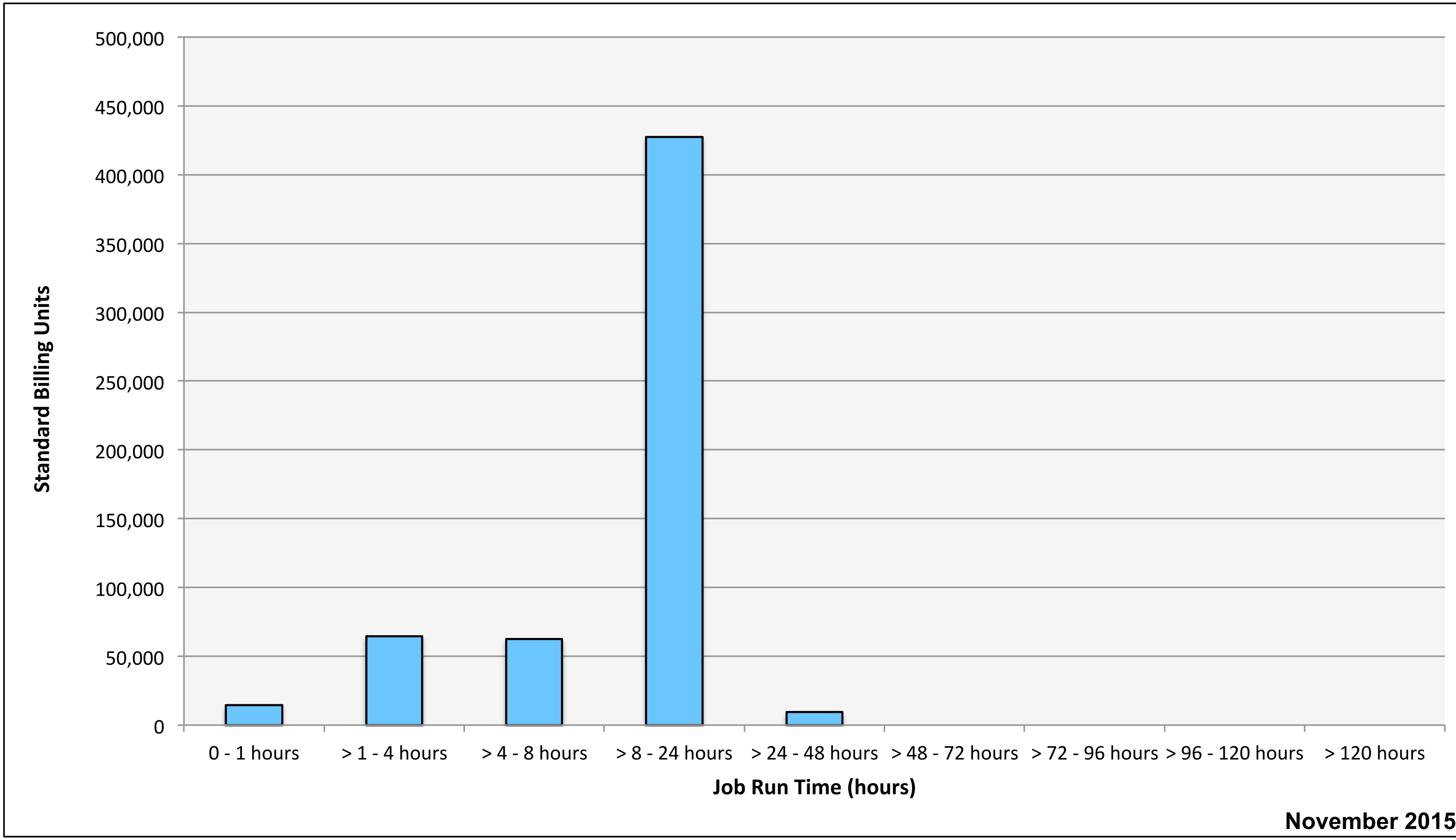
Endeavour: Average Expansion Factor



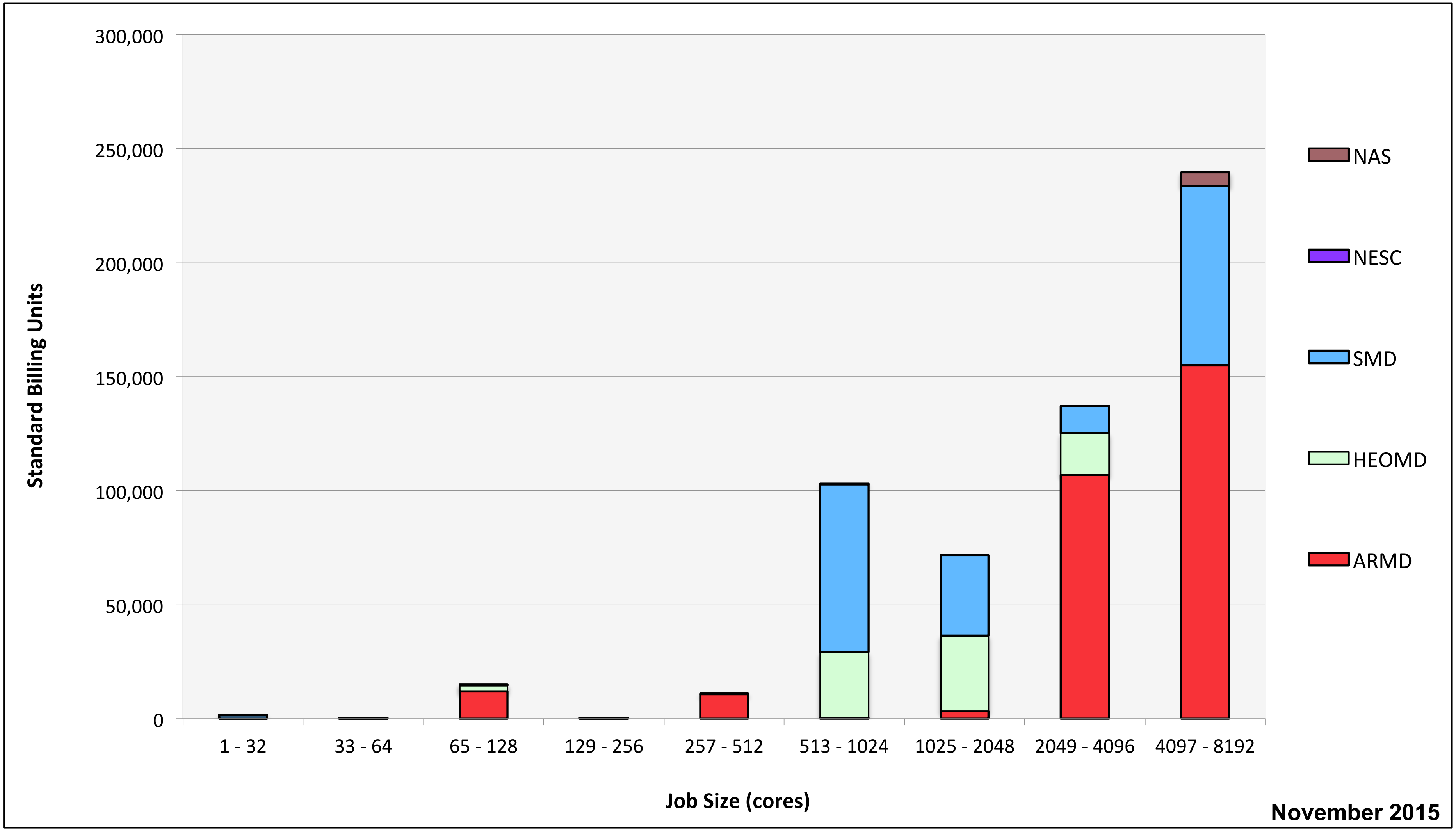
Merope:
SBUs Reported, Normalized to 30-Day Month



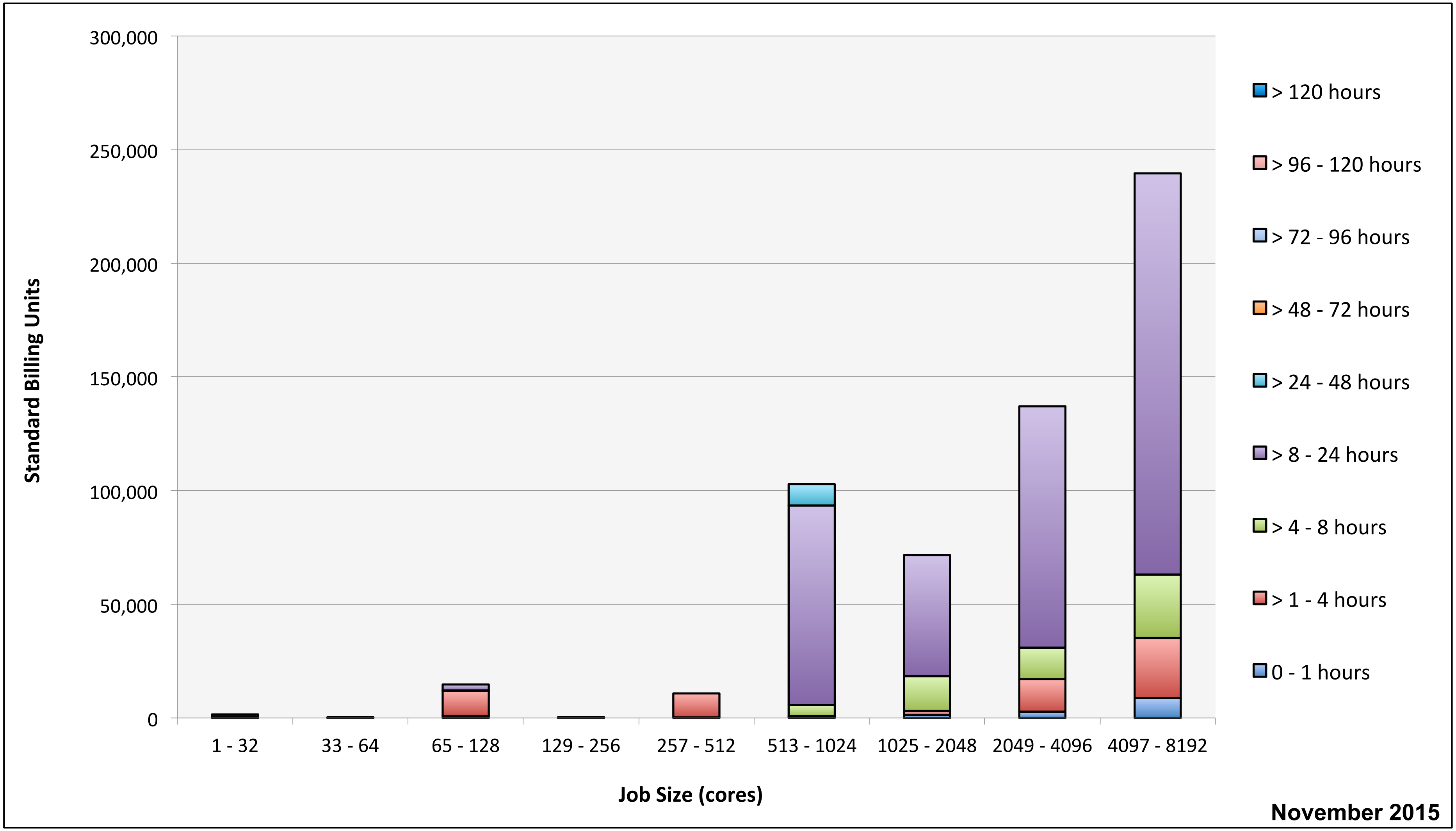
Merope: Monthly Utilization by Job Length



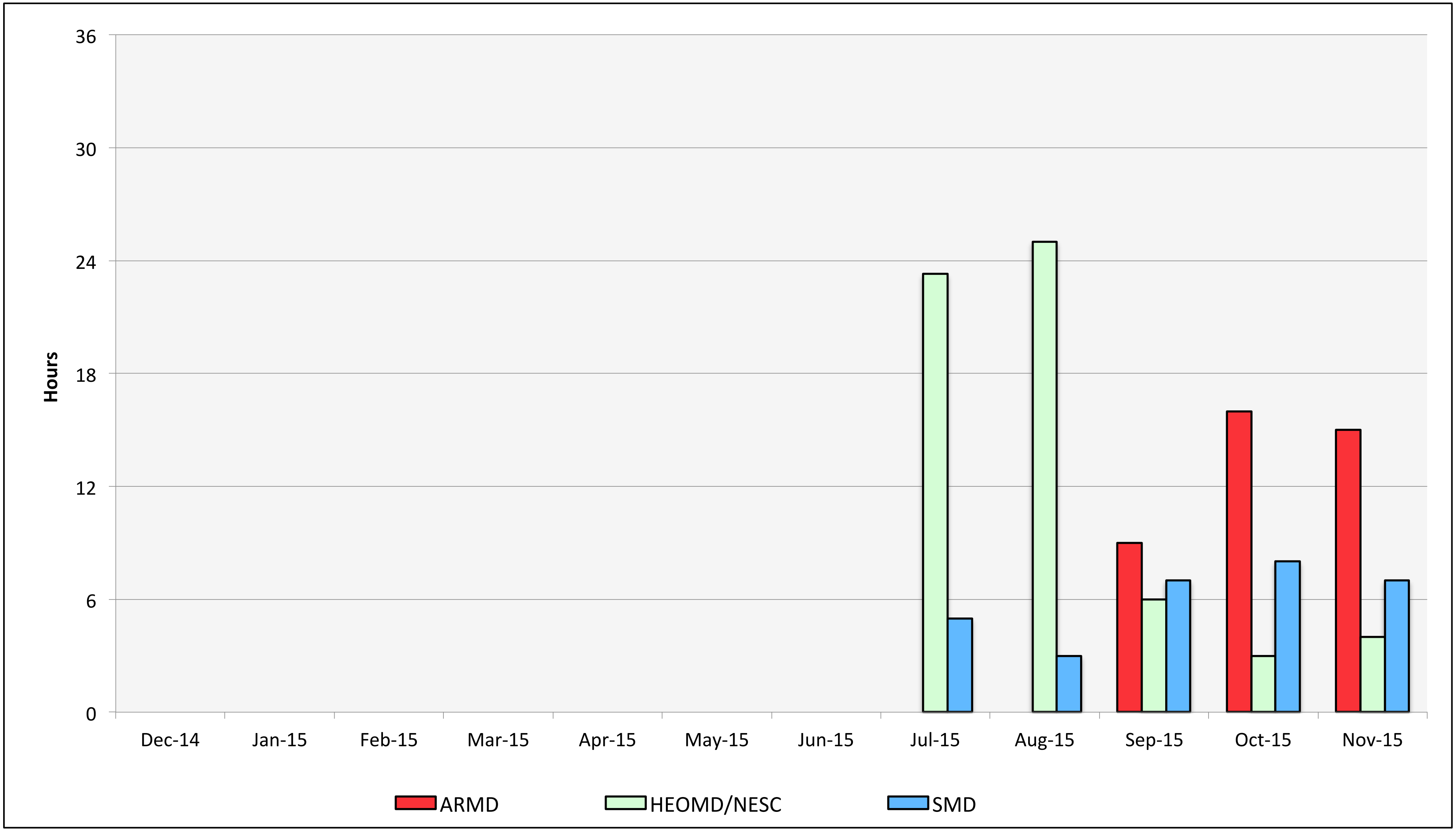
Merope:
Monthly Utilization by Size and Mission



Merope:
Monthly Utilization by Size and Length



Merope:
Average Time to Clear All Jobs



Merope: Average Expansion Factor